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United States Coast Guard

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COMDTNOTE 16500
JAN 22, 2003

COMMANDANT NOTICE 16500

CANCELLED: JAN 22 2004

Subj: CH-5 TO AIDS TO NAVIGATION MANUAL – TECHNICAL, COMDTINST M16500.3A

1. PURPOSE. This Notice promulgates changes to the Aids to Navigation Manual, Technical COMDTINST M16500.3A.

2. ACTION. Area and district commanders, commanders of maintenance and logistic commands, commanding officers of headquarters units, assistant commandants for directorates, Chief Counsel and special staff offices at Headquarters shall ensure that the required changes are made to the Manual. Internet release authorized.

3. PROCEDURES.

   a. Remove & insert the following pages:

Remove	Insert
Table of Contents	Table of Contents
Chapter 2	Chapter 2
Chapter 6	Chapter 6
	Page 7-14A
9-11 thru 9-18	9-11 thru 9-18
9-29 and 9-30	9-29 and 9-30
9-33 thru 9-36	9-33 thru 9-36
9-95 thru 9-104	9-95 thru 9-104
Index	Index

DISTRIBUTION – SDL No. 140

	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
A													2	2	2	2	2		2							
B		1	3		1				2					10	1											
C							2		*		1												2			
D				1																						
E																										
F																										
G																										
H																										

NON-STANDARD DISTRIBUTION: C:i Stations Burlington, St. Ignace and Channel Islands Harbor only (2 copies)

b. Units that have not received Aids to Navigation Manual – Technical, COMDTINST M16500.3A, but have received this change may requisition a copy of the Manual and changes 1, 2, 3 and 4 from the Department of Transportation Warehouse in accordance with the Directives, Publications and Report Index, COMDTNOTE 5600.

c. Paper copies will be distributed to commands that deal directly with aids to navigation. An electronic version of this change is available at http://isddc.dot.gov/ and on the next CG Directives CD-ROM

4. SUMMARY OF CHANGES. Major changes include new topmarks, redesigned fast water buoys, the addition of large mooring chain, updated buoy drawings in Chapter 2, the addition of nominal range tables for all omnidirectional lanterns and a data sheet for the self contained LED lantern in Chapter 6.

5. FORMS AVAILABILITY. Form DD-250, Material Inspection and Receiving Report, is available in JetForm Filler on SWIII.

/s/

J. A. KINGHORN

Rear Admiral, U. S. Coast Guard

Assistant Commandant for Systems

Encl: (1) Change 5 to the Aids to Navigation Manual – Technical

TABLE OF CONTENTS

CONTENTS (cont'd)

CONTENTS (cont'd)

CONTENTS (cont'd)

CONTENTS (cont'd)

CONTENTS (cont'd)

CONTENTS (cont'd)

CONTENTS (cont'd)

CONTENTS (cont'd)

CONTENTS (cont'd)

CONTENTS (cont'd)

TABLE OF CONTENTS

TABLES

TABLES (cont'd)

TABLES (cont'd)

CHAPTER 2. BUOYS AND MOORINGS

A. General. This chapter describes the buoys, moorings, and related equipment that are part of the Coast Guard's aids to navigation system.

B. Buoy Classification. The Coast Guard uses a wide variety of lighted and unlighted steel, foam, and plastic buoys. Lighted buoys and unlighted sound buoys are designated "pillar" buoys by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) due to their cage and tower arrangements.

1. Buoy Identification.

a. Lighted Buoys and Unlighted Sound Buoys. Lighted buoys and unlighted sound buoys are classified according to diameter and length, and various design attributes.

Lighted Buoy Attributes

Designation	Attribute
L	Lighted
R	Radar Reflector
B	Bell
G	Gong
W	Whistle
H	Horn
I	Ice
C	Can-Shaped Radar Reflector
N	Nun-Shaped Radar Reflector
F	Foam

EXAMPLES:

-An 8X26LWR is an eight foot diameter by 26 foot long lighted whistle buoy with a radar reflector.

-A 5X11LNR is a five foot diameter by eleven foot long lighted buoy with a nun-shaped radar reflector.

-A 9X20BR is a nine foot diameter by 20 foot long unlighted bell buoy with a radar reflector.

2.B.1. b. Unlighted Buoys. Unlighted buoys are identified by their shape (can or nun), class (1st through 6th, with 1st being the largest and 6th the smallest), and various design attributes.

Unlighted Buoy Attributes

Designation	Attribute
R	Radar Reflector
C	Can-Shaped
N	Nun-Shaped
I	Ice
F	Foam
P	Plastic
S	Special
T	Tall
FW	Fast Water

EXAMPLES:

-A 2NFR is a second class nun made of foam with a radar reflector.

-A 5NI is a fifth class nun ice buoy.

2. Buoy Serial Numbers.

a. The serial number for lighted buoys and unlighted sound buoys includes the buoy diameter (with an additional letter for Whistle, Ice, Special, or Foam, if applicable), year built, sequential number, and manufacturer's code.

EXAMPLES:

-Buoy 8-93-11-XX is an 8X26LR. Built in 1993, it was the 11th buoy built by contractor XX.

-Buoy 8W-92-31-XX is an 8X26LWR. Built in 1992, it was the 31st buoy built by contractor XX.

-Buoy 8S-94-19-XX is an 8X21LR. Built in 1994, it was the 19th buoy built by contractor XX. An "S" for "special" is used in the serial number for this buoy because of its unique conical hull shape, which differentiates it from a normal 8 foot buoy.

2.B.2.a. -Buoy 7I-94-15-XX is an 7X20LI. Built in 1994, it was the 15th buoy built by contractor XX.

-Buoy 5F-95-08-XX is an 5X9LFR. Built in 1995, it was the 8th buoy built by contractor XX.

b. The serial number for unlighted steel buoys (1st, 2nd, 3rd, and 5th class) and foam buoys (2nd and 3rd class) includes the buoy class, year built, sequential number, and manufacturer's code.

EXAMPLES:

-Buoy 2CR-89-06-XX is a second class can with radar reflector. Built in 1989, it was the 6th buoy built by contractor XX.

c. Plastic unlighted buoys (5th class) are marked with the year built and manufacturer's code.

d. Unlighted foam buoys (4th, 5th, and 6th class) and fast water foam buoys are marked with the buoy class, year built, and manufacturer's code.

e. Steel river buoys (4th and 6th class) are marked with the year built and the manufacturer's code.

f. Lighted plastic discrepancy buoys are marked with the year built and the manufacturer's code.

3. Buoy Configuration Criteria.

a. Standard Buoys. Buoys that are currently being manufactured are designated as standard.

b. Non-Standard Buoys.

(1) Category I. Buoys that are no longer manufactured but are the operational equivalent of standard buoys, and meet the requirements of paragraph 2.B.3.c and Tables 2-1, 2-2, and 2-3. These are authorized substitutes for standard buoys.

(2) Category II. Buoys that are no longer manufactured and are not the operational equivalent of standard buoys, and do not meet the requirements of paragraph 2.B.3.c of this section and Tables 2-1, 2-2,

and 2-3. These buoys **are not authorized substitutes** for standard buoys unless they are upgraded to meet the requirements of Category I non-standard buoys.

c. Requirements for a Category I Non-Standard Buoy.

(1) Buoy Hulls. Buoy hulls shall be of welded construction. **All buoy hulls that are riveted or have components that are riveted (i.e. lift eyes, counterweights, etc.) shall be surveyed and shall not be deployed.**

(2) Towers. Towers must have radar reflectors. 1952 towers are not authorized for bell or gong buoys. Tower legs or feet which are bolted to the hull shall be welded to prevent the loss of the tower.

(3) Battery Pocket Closures. The standard pocket closure is the 6 swing bolt configuration (Data Sheets 2.L.11 through 2.L.13). **The V-band pocket closures are unacceptable and shall be converted to the standard prior to their next deployment.** The 12 swing bolt configuration and bolted flange configuration are acceptable. In many cases, solarization and battery boxes have rendered the pockets unnecessary. The District Commander may authorize welding the pockets shut as detailed in paragraph 2.E.4.f.(3).

(4) Lifting Bails/Mooring Bails.

(a) Standard bails are made from plate steel and externally welded to the buoy hull. (Data Sheet 2.L.24.)

(b) Other existing bails made from plate steel or cast steel that are internally or externally welded are acceptable.

(c) **All 1942 and 1952 type 6X20 buoys without offset lifting bails shall be surveyed and not deployed** due to safety reasons and their age.

(5) Bell/Gong Mounting Flanges. A standard bell/gong mounting flange shall be installed on all lighted buoys, except the 5X11LR and the 3.5X8LR, to allow for buoy battery box installation.

C. Buoy Selection Criteria. There is a wide variety and age of buoys in the field. Proper buoy selection requires consideration of the environmental conditions, operational characteristics, and physical characteristics of the buoys available.

2.C. 1. Environment. Environmental conditions are categorized as exposed, semi-exposed, and protected. These categories are general in nature. Servicing units should consider the wind, wave, and current condition when assessing the buoy's environmental category.

2. Operational Characteristics of Standard Buoys. Tables 2-1 through 2-6 give the operational characteristics of standard buoys. Definitions are provided below.

a. Focal Height of Light. The distance from the waterline to the focal plane of the lantern.

b. Nominal Visual Range of Daymark. The distance at which you can expect to see the buoy if the visibility is 10 nm. Table 2-4 shows the change in visual range under different visibility conditions. The nominal values given in the table are based on certain assumptions about the buoy color, the contrast between the buoy and the background, and the observer's height of eye. These assumptions are described below. The conditions on station will determine the actual visual range of the buoy, which could vary considerably from the values shown in the table.

(1) Background. The visual range of a buoy depends on the contrast between the buoy and its background. For buoys with daymark areas of less than 10 square feet, it is assumed they are contrasted against a sea background. For buoys with daymark areas of 10 square feet or more, it is assumed they are contrasted against both sea and sky. The amount of the buoy seen against the sky will depend on the height of eye of the observer. As the observer's height of eye increases, less of the buoy will be seen against the sky and its visual range will decrease. The values in the tables are based on a height of eye of 15 feet.

(2) Color. The color of the buoy also affects its ability to be seen. For the values provided in the tables, it is assumed the buoys are either IALA red or IALA green.

c. Radar Range. Radar ranges are calculated from complex theoretical equations that consider not only the radar reflector configuration of the buoy, but also the characteristics of the radar set. The ranges determined by this theory have been substantiated by field testing. The ranges represent an average range at which a blip/scan ratio of 0.2 is obtained. The stereotype radar set used in determining these ranges has the following characteristics:

2.C.2.c (1) antenna height, 10 ft.
(2) peak transmitted power, 3 kW.
(3) wavelength, 3 cm.
(4) antenna gain, 25 dB.
(5) receiver noise figure, 12 dB.
(6) 1F bandwidth, 10 MHz.
(7) frequency, 9.4 GHz.
(8) noise factor, 16 dB.

d. Minimum Mooring Depth. Depth of water required to keep the buoy counterweight clear of the bottom. Tidal and sea conditions will affect the minimum mooring depth.

e. Maximum Mooring Depth. The maximum mooring depth for a given buoy depends on the size of chain used. In areas with excessive wear rates, a larger diameter chain **is recommended** for use in the chafe section to extend the time between mooring inspections. Guidance is provided in Tables 2-5 and 2-6. **The Computer-Aided Mooring Selection Guide, MOORSEL, may also be used to assist in the selection of the mooring configuration.**

f. Minimum Freeboard. The minimum freeboard needed to ensure the buoy will function as designed.

g. Pounds-per-Inch of Immersion. Weight that will submerge the buoy one inch. This value is used to determine the freeboard with different moorings or power units.

3. Physical Characteristics of Standard Buoys. Tables 2-7, 2-8, and 2-9 provide the physical characteristics of standard buoys. The values given in these tables are for buoys without moorings, power units, or sound signal equipment. Definitions are provided below.

a. Buoy Weight. This is the weight of the buoy in air.

b. Flooded Weight. This is the weight of the buoy in air with its hull and pockets flooded.

c. Buoy Draft. Buoy draft is the distance from the waterline of the buoy to its lowest underwater part, not including mooring.

d. Freeboard. Freeboard is the distance from the waterline to the top of the hull.

Table 2-1

OPERATIONAL CHARACTERISTICS OF STANDARD LIGHTED BUOYS*

				SEMI-EXPOSED								
	EXPOSED						PROTECTED					
Buoy Type / Characteristics	9X35 LWR	9X32 LR	9X20 BR/GR	8X26 LR	8X26 LWR	8X21 LR	7X20 LI	7X17 LR	6X20 LR	5X11 LR	5X9 LFR	3.5X8 LR
FOCAL HEIGHT OF LIGHT (FT-IN) (At minimum freeboard)	20-7	21-2	——	15-11	15-10	13-4	9-10	11-5	10-9	8-0	6-7	5-7
NOMINAL VISUAL RANGE OF DAYMARK (NM)	3.2	3.8	3.0	3.2	3.2	3.0	1.4	2.3	2.1	1.4	1.4	1.4
RADAR RANGE (NM)	4.0	4.5	3.7	3.7	3.7	3.7	0.5	2.7	2.4	1.7	1.3	1.3
MINIMUM MOORING DEPTH (FT)	35	30	15	25	25	18	25	17	20	13	10	11
MAXIMUM MOORING DEPTH (FT)	SEE TABLE 2-5 AND 2-6											
MINIMUM FREEBOARD (IN)	14	22	12	15	15	11	30	14	10	10	5	6
LB PER INCH OF IMMERSION	300	340	340	264	250	264	170	205	150	105	119	50

*NOTE: ALSO INLCUDES 9X20 UNLIGHTED SOUND BUOY

Table 2-2

OPERATIONAL CHARACTERISTICS OF STANDARD UNLIGHTED STEEL BUOYS

			SEMI-EXPOSED															
	EXPOSED				PROTECTED				ICE				RIVER					
Buoy Type / Characteristics	1 CR	1 NR	2 CR	2 NR	3 CR	3 NR	5 CR	5 NR	3 CI	3 NI	5 CI	5 NI	4 CR	4 NR	6 CR	6 NR	6 CT	6 NT
NOMINAL VISUAL RANGE OF DAYMARK (NM)	3.8	3.5	2.8	2.6	1.4	1.4	1.2	1.2	1.4	1.4	1.2	1.2	1.4	1.4	1	1	1	1
RADAR RANGE (NM)	3.5	3.5	2.5	3.0	1.6	1.8	1.25	1.25	0.5	0.5	0.5	0.5	1.5	1.5	1	1	0.5	0.5
MINIMUM MOORING DEPTH (FT)	15	15	15	15	10	10	10	10	15	15	10	10	10	10	6	6	6	6
MAXIMUM MOORING DEPTH (FT)	**SEE TABLE 2-5 AND 2-6**												115	115	60	60	37	49
MINIMUM FREEBOARD (FT-IN)	2-2	2-3	1-6	1-7	0-11	0-11	0-11	0-11	3-9	4-11	2-2	3-2	1-0	1-0	0-6	0-6	1-6	2-6
LB PER INCH OF IMMERSION	104	104	67	67	38	38	16	16	22	22	16	16	21	21	9	9	9	9

Table 2-3

OPERATIONAL CHARACTERISTICS OF STANDARD FOAM AND PLASTIC UNLIGHTED BUOYS

	EXPOSED		SEMI-EXPOSED				PROTECTED							
Buoy Type / Characteristics	2 CFR	2 NFR	3 CFR	3 NFR	4 CFR	4 NFR	5 CFR	5 NFR	6 CFR	6 NFR	FW NFR	FW CFR	5 CPR	5 NPR
NOMINAL VISUAL RANGE OF DAYMARK (NM)	2.6	2.6	2.0	2.0	1.4	1.4	1.2	1.2	1.0	1.0	1.0	1.0	1.0	1.0
RADAR RANGE (NM)	1.5	1.5	1.5	1.5	0.75	0.75	0.5	0.5	0.4	0.4	0.5	0.5	0.5	0.5
MINIMUM MOORING DEPTH (FT)	15	15	10	10	10	10	6	6	6	6	3	3	7	7
MAXIMUM MOORING DEPTH (FT)	**SEE TABLE 2-5 AND 2-6**													
MINIMUM FREEBOARD (IN)	10	10	6	6	4	4	4	4	16	16	5	5	25	25
LB PER INCH OF IMMERSION	119	119	72	72	47	47	26	26	12	12	38	38	15	15

Table 2-4

CHANGE IN VISUAL RANGE OF BUOY TYPES VERSUS CHANGE IN VISIBILITY (NM)

BUOY TYPE \ VISIBILITY (nm)	2.0	2.5	5.0	7.5	10.0 (Nominal Range)	12.5	15.0
9X35LWR	1.5	1.7	2.3	2.6	3.2	3.5	3.8
9X32LR	1.7	2.0	2.8	3.3	3.8	4.0	4.1
9X20BR/GR	1.5	2.0	2.4	2.8	3.0	3.1	3.3
8X26LR/LWR	1.5	1.7	2.3	2.6	3.2	3.5	3.8
8X21LR	1.5	2.0	2.4	2.8	3.0	3.1	3.3
7X20LI	0.9	1.0	1.2	1.4	1.4	1.4	1.4
7X17LR	1.2	1.5	2.0	2.1	2.3	2.5	2.6
6X20LR	1.0	1.3	1.8	2.0	2.1	2.3	2.3
5X11LR	0.9	1.0	1.2	1.4	1.4	1.4	1.4
5X9LFR	0.9	1.0	1.2	1.4	1.4	1.4	1.4
3 1/2X8LR	0.8	0.9	1.1	1.2	1.4	1.4	1.4
1CR	1.6	1.8	2.7	3.3	3.8	4.0	4.2
1NR	1.5	1.7	2.6	3.1	3.5	3.8	4.0
2CR	1.2	1.3	1.9	2.5	2.8	3.1	3.3
2NR	1.2	1.3	1.8	2.2	2.6	2.8	2.9
3CR/NR	0.8	1.0	1.2	1.3	1.4	1.4	1.4
4CR/NR	0.8	1.0	1.2	1.3	1.4	1.4	1.4
5CR/NR	0.7	0.8	1.0	1.1	1.2	1.2	1.2
6CR/NR, 6CT/NT	0.7	0.8	0.9	0.9	1.0	1.0	1.0
3CI/NI	0.8	0.9	1.1	1.2	1.4	1.4	1.4
5CI/NI	0.7	0.8	1.0	1.1	1.2	1.2	1.2
2CFR/NFR	1.2	1.3	1.8	2.2	2.6	2.8	2.9
3CFR/NFR	1.0	1.2	1.6	1.8	2.0	2.1	2.1
4CFR/NFR	0.8	1.0	1.2	1.3	1.4	1.4	1.4
5CFR/NFR	0.7	0.8	1.0	1.1	1.2	1.2	1.2
6CFR/NFR	0.7	0.8	0.9	0.9	1.0	1.0	1.0

2.C.3.d.

Table 2-5

MAXIMUM MOORING DEPTHS FOR RECOMMENDED CHAIN SIZES

	CHAIN SIZE									
BUOY TYPE	1-7/8"	1-3/4"	1-5/8"	1-1/2"	1-1/4"	1-1/8"	1"	7/8"	3/4"	1/2"
9X35LWR	127	144	165	191						
9X32LR	217	248	285	332						
9X20R			183	261						
8X26LR				175	250					
8X26LWR				166	236					
8X21LR				128	182	224				
7X20LI				33	47	60	75			
7X17LR				133	189	233	291			
6X20LR				69	97	120	149			
5X11LR					69	84	105			
5X9LFR							62	81	110	
3.5X8LR							33	41	55	
1CR				121	174	216				
1NR				126	182	226				
2CR					78	97	121			
2NR					81	101	127			
3CR							43	56	76	
3NR							43	56	76	
3CI							30	39	53	
3NI							27	35	48	
5CR										67
5NR										67
5CI										50
5NI										50
2CFR						91	115	149	204	
2NFR						91	115	149	204	
3CFR								60	82	179
3NFR								60	82	179
4CFR									37	80
4NFR									37	80
5CFR										40
5NFR										40
6CFR										21
6NFR										21
FWCFR										71
FWNFR										71
5CPR										35
5NPR										35

Example: An 8X26LR with 1-1/2" chain can be moored at a depth of 175 feet. The same buoy with 1-1/4" chain can be moored at a depth of 250 feet. An 8X26LR with a combination of 1-1/2" and 1-1/4" chain should be moored at a depth between 175 and 250 feet. This depth can be found by interpolating between the two depths based on the amounts of 1-1/2" and 1-1/4" chain used.

Table 2-6

CORRECTION FACTORS TO ADJUST THE MAXIMUM MOORING DEPTH PER 100 POUNDS OF ADDITIONAL BUOY WEIGHT

(e.g., Sound Signals, Lighting Equipment, etc.)

	CHAIN SIZE								
BUOY TYPE	1-7/8"	1-3/4"	1-5/8"	1-1/2"	1-1/4"	1-1/8"	1"	7/8"	3/4"
9X35LWR	-2'	-2.5'	-2.5'	-3'					
9X32LR	-2'	-2.5'	-2.5'	-3'					
9X20R				-3'	-4.5'				
8X26LR				-3'	-4.5'				
8X26LWR				-3'	-4.5'				
8X21LR				-3'	-4.5'	-5.5'			
7X17LR				-3'	-4.5'	-5.5'	-7'		
6X20LR				-3'	-4.5'	-5.5'	-7'		
5X11LR					-4.5'	-5.5'	-7'		
5X9LFR							-7'	-9'	-12'
3.5X8LR							-7'	-9'	-12'

Example: The maximum mooring depth for an 8X26LR with 1-1/4" chain is 250ft. If 400 pounds of equipment (battery box and lighting equipment) is added, the new maximum mooring depth will be 232ft. This is found by locating the correction factor for an 8X26LR buoy moored with 1-1/4" chain (-4.5), and multiplying this factor by how many hundreds of pounds were added (in this example, 4). Add this result to the the original maximum mooring depth and you will get the corrected maximum mooring depth:

1-1/4" chain = Correction Factor of -4.5ft
250' + (4 x -4.5ft) = 232ft

Table 2-7

PHYSICAL CHARACTERISTICS OF STANDARD LIGHTED BUOYS*

Characteristics \ Buoy Type	9X35 LWR	9X32 LR	9X20 B/GR	8X26 LR	8X26 LWR	8X21 LR	7X20 LI	7X17 LR	6X20 LR	5X11 LR	5X9 LFR	3.5X8 LR
BUOY WEIGHT (LB)	18,500	17,500	8,000	11,800	12,100	13,900	6,500	7,800	6,500	3,000	1,500	1,500
FLOODED WEIGHT (LB)	52,000	53,000	24,000	34,000	33,000	33,000	19,000	24,500	17,000	9,000	——	4,000
BUOY DRAFT (FT-IN)	15-10	11-7	5-4	10-4	10-5	7-9	10-7	5-6	9-0	3-9	2-9	2-9
FREEBOARD (FT-IN)	3-0	4-7	2-6	3-1	3-0	2-3	3-1	3-0	2-1	2-1	1-1	1-4
BRIDLE SIZE CHAIN DIA X LENGTH (IN X FT)	1-1/2 20	1-1/2 18	1-1/4 15	1-1/4 15	1-1/4 15	1-1/4 15	1-1/4 15	1-1/4 15	1 12	1 12	——	7/8 10
MOORING CHAIN SIZE (IN)	**SEE TABLE 2-12**											
SINKER SIZE (LB)	12,750	12,750	8,500	8,500	8,500	8,500	* *	8,500	5,000	4,000	4,000	3,000

* NOTE: ALSO INCLUDES 9X20 UNLIGHTED SOUND BUOY

* * NOTE: USE SINKER EQUIPMENT FROM PERMANENT AID

2.C.3.d.

Table 2-8
PHYSICAL CHARACTERISTICS OF STANDARD UNLIGHTED STEEL BUOYS

Bouy Type / Characteristics	1 CR	1 NR	2 CR	2 NR	3 CR	3 NR	5 CR	5 NR	3 CI	3 NI	5 CI	5 NI	4 CR	4 NR	6 CR	6 NR	6 CT	6 NT
BUOY WEIGHT (LB)	6,100	6,000	2,800	2,600	1,200	1,175	710	710	1,550	1,550	700	700	465	470	160	165	165	170
FLOODED WEIGHT (LB)	18,500	18,400	8,400	8,300	3,200	3,200	1,800	1,800	4,200	4,200	1,900	1,900	-----	-----	-----	-----	-----	-----
BUOY DRAFT (FT-IN)	8-7	8-4	6-3	6-1	4-4	4-4	5-1	5-1	7-7	7-7	5-0	5-0	5-0	5-0	3-10	3-10	4-0	4-0
FREEBOARD (FT-IN)	5-5	5-8	3-9	3-11	2-4	2-4	2-3	2-3	5-5	6-5	3-2	4-2	2-11	2-11	2-5	2-5	2-9	4-2
MOORING CHAIN SIZE (IN)	**SEE TABLE 2-12**												1/2*	1/2*	1/2*	1/2*	1/2*	1/2*
SINKER SIZE (LB)	8,500	8,500	4,000	4,000	3,000	3,000	2,000	2,000	3,000	3,000	2,000	2,000	2,000	2,000	500	500	500	500

*NOTE: USUALLY MOORED WITH 1/2" (3/8") WIRE ROPE.

Table 2-9

PHYSICAL CHARACTERISTICS OF STANDARD FOAM AND PLASTIC UNLIGHTED BUOYS

Bouy Type / Characteristics	2 CFR	2 NFR	3 CFR	3 NFR	4 CFR	4 NFR	5 CFR	5 NFR	6 CFR	6 NFR	FW CFR	FW NFR	5 CPR	5 NPR
BUOY WEIGHT (LB)	1,100	1,025	525	500	195	180	115	115	65	65	200	195	114	114
BUOY DRAFT (FT-IN)	5-3	5-3	3-1	3-1	2-10	2-10	3-0	3-0	2-4	2-4	1-1	1-1	3-6	3-6
FREEBOARD (FT-IN)	2-0	2-0	1-4	1-4	0-11	0-11	0-10	0-10	1-11	1-11	1-0	1-0	3-0	3-0
MOORING CHAIN SIZE (IN)	**SEE TABLE 2-12**													
SINKER SIZE (LB)	3,000	3,000	2,000	2,000	1,000	1,000	500	500	500	500	1000+	1000+	500	500

2.D.

New Buoys.

1. New Buoys. New buoys are fabricated by commercial contractors in accordance with Commandant (G-SEC-2) specifications. DD-250 shipping document(s) must accompany buoy shipments. Ensure that the types, colors, and quantities of the buoys shipped agree with the DD-250. Check for damage that may have occurred during shipment. DD-250s shall be mailed or faxed to Commandant (G-SEC-2) as specified on the bottom of the DD-250. Contact Commandant (G-SEC-2) **immediately** if a buoy is damaged.

2. Air Test. New steel ocean buoys shall be air tested in accordance with paragraph 2.E.4.m.(1) before delivery to the servicing unit. Contact Commandant (G-SEC-2) **immediately** if a new buoy hull fails an air test.

E. Steel Buoy Maintenance. Steel buoy maintenance is performed by Coast Guard and commercial industrial facilities. A flowchart describing the decisions made in the steel buoy maintenance process is shown in Figure 2-1.

1. Definitions.

a. Overhaul. Overhaul includes repair to the buoy hull and tower, any required upgrades, blast cleaning, and painting.

b. Repair. Work required to fix or replace any part of the buoy that has been damaged.

c. Upgrade. Work required to improve the buoy from a Category II to a Category I buoy.

d. Outfitting. Equipping the buoy hull with the proper hardware and appendages.

e. Survey. Decision to identify a buoy as no longer fit for service. The decision is usually based on the cost to overhaul the buoy.

f. Scrapping. Disposing of a surveyed buoy in accordance with Federal, state, and local laws and regulations.

g. Appendages. Signal equipment that is bolted or pinned to the hull (bells, tappers, lighting equipment, racons, etc).

2. Economic Repair and Upgrade of Steel Buoys. Economic feasibility of repairing and upgrading steel buoys is based on labor hours. The maximum labor hour limits for buoy repairs and upgrades are listed in Table 2-10. These limits do not include blast cleaning, painting, and outfitting.

Table 2-10

LABOR HOUR LIMITS FOR ECONOMICAL REPAIR AND UPGRADE OF STEEL BUOYS AND TOWERS

(Excluding blast cleaning, painting, and outfitting)

BUOY TYPE	HOURS (TOWER)*	HOURS (TOTAL BUOY)**
9X35	40	90
9X32	30	90
9X20, 8X21	20	70
8X26	20	70
7X20		25
7X17, 6X20	10	45
5X11, 3.5X8		25
1CR/1NR		25
2CR/2NR		25
3CR/3NR		10
3CI/3NI		5
5CR/5NR		5
5CI/5NI		5

* As indicated in paragraph 2.E.4.d.(2) towers may be replaced instead of repaired.

** Includes all hours required for repair and upgrade of the entire buoy including the tower.

3. Survey of Steel Buoys. When a buoy cannot be economically repaired and upgraded within the Labor Hour Limits of Table 2-10, it shall be surveyed. A Category II non-standard buoy that cannot be economically repaired and upgraded to a Category I buoy shall also be surveyed.

   a. Scrapping Surveyed Buoys. Upon approval of the District Commander, surveyed buoys shall be disposed of in accordance with Federal, state, and local regulations. Cast counterweights and other buoy parts may be salvaged for re-use.

2.E.3.b.

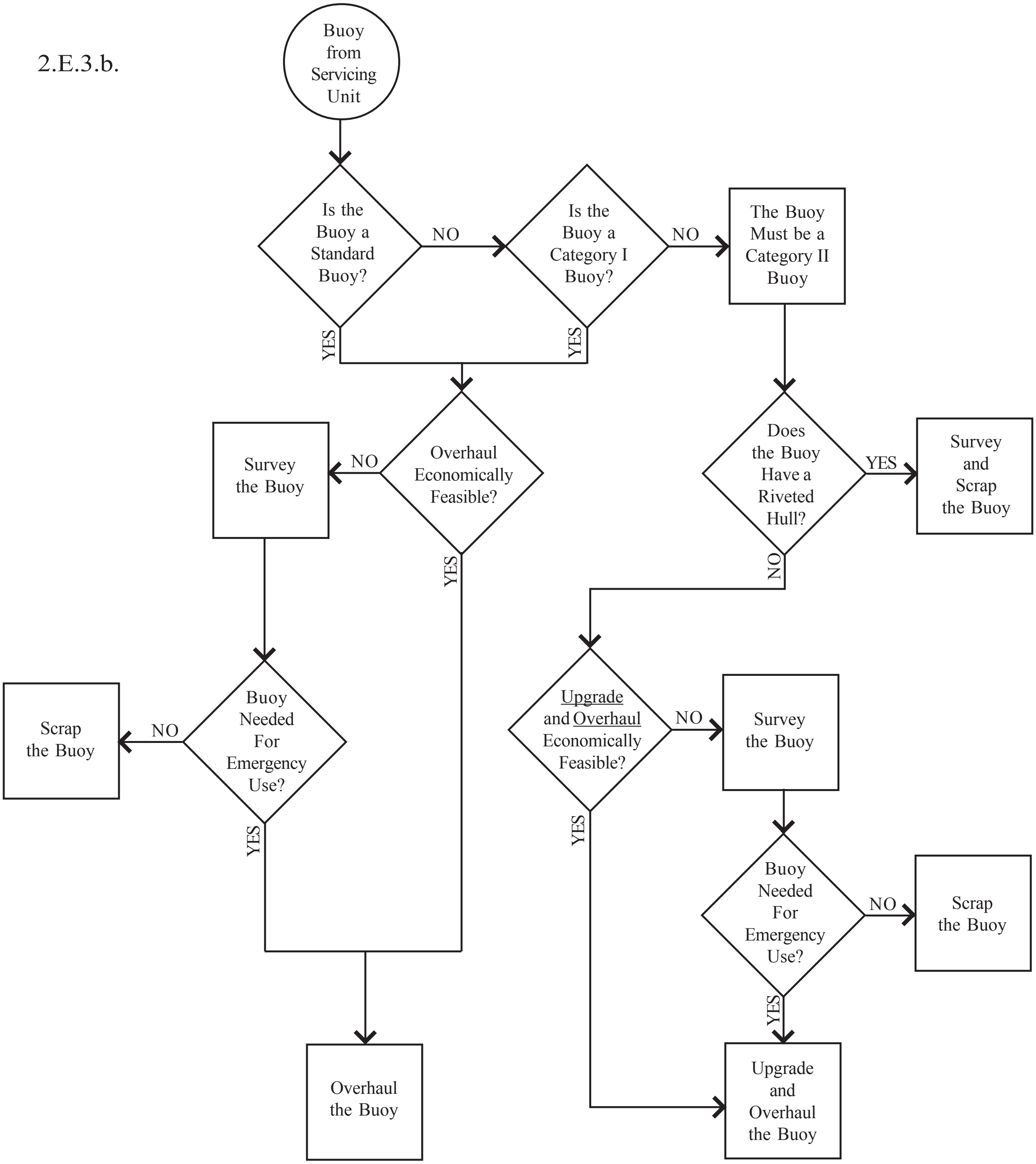


Figure 2-1

STEEL BUOY MAINTENANCE DECISION FLOW CHART

2.E.3.b. b. Emergency Use of Surveyed Buoys. The District Commander may authorize overhauling a surveyed buoy to meet an emergency need. If a surveyed buoy is overhauled it shall be deployed only once for a period not to exceed six years. An "S" twice the size of the serial number shall be welded at the end of the serial number to prevent survey duplication and repeated overhauls.

4. Overhaul of Steel Buoys.

a. Gas-Free Testing. Be aware that combustible gases could be present in the buoy hull. Before beginning any work on the buoy, the hull shall be tested for combustible gases using a combustible gas monitor or explosive meter. Insert the probe from the meter into the buoy body air test fitting.

(1) If no combustible gases are detected, then work can be performed on the buoy.

(2) If combustible gases are detected, the buoy hull shall be purged with compressed air to displace the combustible atmosphere. If the hull is equipped with two air test fittings (see paragraph 2.E.4.m), ensure that both fittings are open to improve the air flow.

b. Preparation. Prior to blast cleaning, all appendages shall be removed, and all threaded surfaces shall be covered for protection.

c. Blasting. The buoy shall be blasted in accordance with the *Coatings and Color Manual* COMDTINST M10360.3 (series) prior to any cutting or welding.

d. Towers.

(1) Towers shall be welded to the buoy hull. Tower legs bent more than 3 inches from a straight line over a 2 foot length shall be straightened. The tower centerline shall not be more than two degrees from perpendicular to the waterline. Radar reflector panels shall not exceed 3 degrees from a right angle. The lantern mounting surface and lantern ring shall be parallel to the waterline.

(2) Towers not meeting the criteria outlined in paragraph 2.B.3.c.(2), and towers that cannot be economically repaired in the time specified in Table 2-10 shall be replaced. New buoy towers are available on commercial contract and can be ordered through Commandant (G-SEC-2).

e. Buoy Hull. Any damage that penetrates the hull shall be repaired. Severe dents and creases (12 inches long or 4 inches deep) shall be repaired, returning the buoy body to its approximate original shape. All buoy hulls shall be air tested in accordance with paragraph 2.E.4.m prior to painting.

f. Battery Pockets .

(1) Closures. **All V-band pocket closures shall be replaced** with the standard pocket closure as illustrated in Data Sheets 2.L.11 through 2.L.13. The standard battery pocket conversion kit, shown in Data Sheet 2.L.14, is available through the stock system.

(2) Gaskets. Battery pocket cover gaskets shall be replaced. Gasket material included in Data Sheets 2.L.11 through 2.L.13 is available through the stock system. Gaskets for non-standard pocket covers are no longer available through the stock system. Remember that overtightening the swing bolts could crack the gasket, which would compromise the watertight integrity of the battery pockets.

(3) Permanently Closing the Battery Pocket. The battery pocket may be welded shut per paragraph 2.B.3.c.(3). The pocket may either be cut flush with the top head or just below the flange. A plate shall then be welded over the pocket opening.

(4) Vent Lines. The vent lines shall be inspected for any damage or obstructions that would impair the flow of air or allow flooding of the battery pocket(s). All damage shall be repaired or replaced as appropriate. The stainless steel unions may be removed and stainless steel couplings may be welded in their place. Damaged threads at the end of vent lines shall be repaired. When there are no batteries in either battery pocket, the vent valves may be removed and vent lines capped with a 3/4" stainless steel pipe cap.

(5) Crossover Tubes. Crossover tubes shall be inspected for any damage or obstructions that would impair the flow of air. Specifically, ensure the tubes are free of blast grit, paint chips, dirt, or other foreign material.

(6) Air Test. Battery pockets shall be tested in accordance with paragraph 2.E.4.m before painting.

2.E.4.g. g. Lifting Bails. Standard lifting bails are machined from plate steel and externally welded to the buoy hull. (Data Sheet 2.L.24).

(1) Non-Standard Bails. Lifting bails made from plate steel or cast steel that are internally or externally welded to the buoy hull are acceptable.

(2) Testing. The following guidelines apply to all lighted buoys and unlighted buoys 3rd class and larger:

(a) The integrity of lifting bails is vital to the safety of buoy handling operations**.** Failure of a lifting bail could lead to serious injury. Therefore, it is paramount to ensure the quality of the welding on this critical component. Non-destructive testing is extremely important for buoys that have been in service and are undergoing overhaul. Lifting bails are subjected to repeated lifting while in service which can weaken the weld and the surrounding metal. **If any welds which attach the lifting bails to the buoy hulls are of questionable integrity, then non-destructive testing (NDT) shall be performed using the magnetic particle method.**

(b) Magnetic-particle testing procedures and techniques shall be in accordance with ASTM E709. Personnel performing NDT shall be certified to Level II in accordance with the current edition of the American Society for Nondestructive Testing Recommended Practice No. SNT-TC-1A. The NDT inspector can be either a Coast Guard employee or a commercial contractor.

(c) Repair weld defects in accordance with American Welding Society (AWS) D.1.1.

h. Mooring Attachments.

(1) Mooring Bails. Worn mooring bails shall be repaired or replaced if economically feasible (reference Table 2-10). Repaired mooring bails shall be built up to original size and shape by welding or inserting sleeve bushings. Hardfacing material shall be used when weld build-up is the repair method.

(2) Mooring Arms. Bent mooring arms should be straightened or replaced if they do not function properly. The mooring arm pin and the mooring arm shall be repaired or replaced when the clearance between them

exceeds 5/8 inch. If the hole in the lower end of the mooring arm has worn by more than 1/2 inch in diameter, it shall be repaired or the mooring arm shall be replaced. Hardfacing material shall be used when weld build-up is the repair method. All pre-1991 mooring arms should be replaced with the current shorter arms.

(3) Testing. **If any welds which attach the mooring bails or the mooring arm pins to the buoy hull are of questionable integrity, then non-destructive testing shall be performed using the magnetic particle method** outlined in paragraph 2.E.4.g.(2)(b).

i. Miscellaneous Bails. Miscellaneous bails such as the cage line attachment on 7X20LI buoys, and the lifting bails on 5X11LR radar reflectors shall be inspected, and repaired or replaced as necessary.

j. Buoy Counterweight Tubes.

(1) Bent counterweight tubes shall be replaced.

(2) The welds at the junction of the tube and buoy hull shall be inspected and repaired as required.

(3) Steel doubler plates (6 X 24 X 3/8 inches) shall be installed between the gussets and buoy hull on all 1962-type 8X26LR buoys not previously modified.

k. Counterweights. The space between the counterweight and tube shall be filled with asphalt enamel. 10 inch tall counterweights on 6X20LR buoys and 21 inch tall counterweights on 8X26LR buoys shall be replaced with standard counterweights.

l. Chafing Blocks. Chafing blocks are not required on buoys with 12 inch diameter counterweight tubes. Worn chafing blocks shall be replaced with salt-treated wood or hardwood. Retaining pins shall be replaced with nuts and bolts. The nuts shall be welded in place to prevent their loss. New chafing blocks shall be installed after the finish coat of paint is applied to the buoy.

m. Air Test. **All lighted and unlighted steel ocean buoys shall be retrofitted with a second air test coupling on the buoys hull to facilitate the gas freeing procedure (2.E.4.a.(2) and 2.J.2.f.(4)(b))**. Prior to priming and painting, the buoy hull and buoy battery pockets shall be air tested as outlined below. Do not over-pressurize the buoy body or battery pockets, as it can lead

2.E.4.m. to catastrophic failure. Differences between the temperature of the incoming air and the buoy can lead to over-pressurization.

(1) Buoy Hull Air Test. The buoy hull shall hold 3 psi for 10 minutes. Any buoy hull failing the air test shall be repaired and re-tested. Air test procedures and apparatus are described below.

(a) Prior to pressurizing the hull, the battery pocket covers must be removed. With the apparatus described below, pressurize the buoy hull to 3 psi and secure the air source. The hull must hold the pressure for 10 minutes. Any drop in pressure is a buoy hull air test failure.

(b) The source of the test air shall be the lowest pressure practicable. The air test apparatus shall consist of:

1. A calibrated pressure gage with a scale no greater than 20 psi and an accuracy of plus or minus 1%.

2. A pressure regulator installed in the line that reduces the pressure to 3 psi.

3. A relief valve that automatically relieves pressure greater than 5 psi. The valve shall be non-adjustable and capable of independently reducing the hull air pressure more rapidly than it can be increased by the air source.

4. A valve shall be provided to vent off the pressure at the end of the test.

(2) Buoy Battery Pocket Air Test. The buoy battery pocket shall hold between 1 and 2 psi for 5 minutes. Any battery pocket failing the air test shall be repaired and re-tested.

(a) With the apparatus depicted in Figure 2-2, pressurize the battery pockets to between 1 and 2 psi and secure the air source. The battery pockets must hold the pressure for 5 minutes. Any drop in pressure is a battery pocket air test failure.

2.E.4.m.(2).

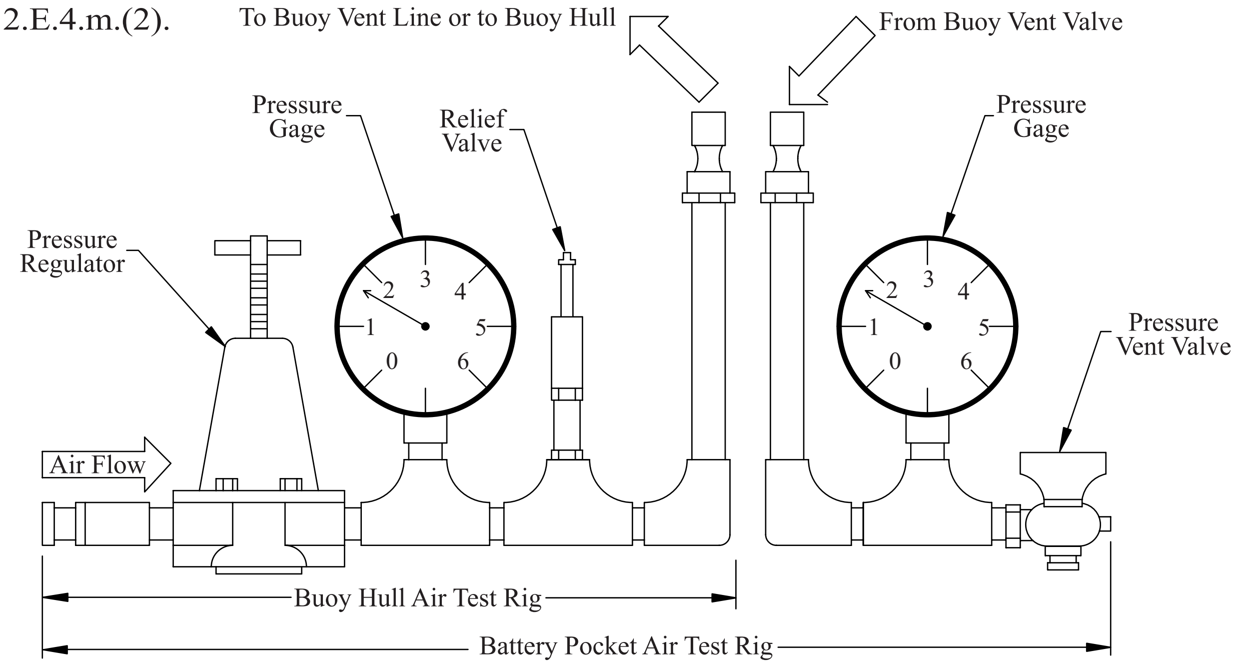


Figure 2-2
AIR TEST RIG

(b) The source of the test air shall be the lowest pressure practicable. The air test apparatus shall consist of:

1. Two calibrated pressure gages with a scale no greater than 20 psi and an accuracy of plus or minus 1%.

2. A pressure regulator installed in the line that reduces the pressure to 2 psi.

3. A relief valve that automatically relieves pressure greater than 5 psi. The valve shall be non-adjustable and capable of independently reducing the pocket air pressure more rapidly than it can be increased by the air source.

4. A valve shall be provided to vent off the pressure at the end of the test. Pressure shall be vented slowly to prevent damage to the batteries.

n. Battery Boxes. Battery boxes shall be repaired or replaced as necessary.

o. Sound Signals. Sound signal appendages are stocked, maintained, and installed by industrial facilities.

(1) Whistles. **Replace whistle balls each time the buoy is overhauled.** After installation on the buoy, the space between the whistle bell and the whistle body shall be adjusted to 15/16 $\pm$ 1/16 in. Whistles are depicted on Data Sheets 2.L.4 and 2.L.5.

(2) Bells. Bells do not require any special preparation. Bells are depicted on Data Sheet 2.L.6.

(3) Gongs. Gongs do not require any special preparation. Gongs are depicted on Data Sheet 2.L.8.

(4) Bell and Gong Stands. Bell and gong stands shall be blasted and inspected for cracks. Damaged stands shall be repaired or replaced. Properly prepare and paint the entire stand prior to installation. Ensure new isolation pads are installed between the stand and the bell or gong. Stainless steel nylock nuts and lock washers shall be used. Bell and gong stands are depicted on Data Sheet 2.L.7 and 2.L.9, respectively.

(5) Tappers.

(a) Standard Tappers. The standard tapper shown on Data Sheet 2.L.10 is available through the stock system. This adjustable tapper replaces all 1952- and 1962-type tappers.

(b) Non-Standard Tappers. The 1952-type tapper is no longer approved for use. The 1962-type tapper may still be used.

(c) Tapper Ball Adjustment. After the tapper is mounted, the tapper ball shall be adjusted to the correct height and the nuts tightened. The tapper ball shall be adjusted so that its centerline is located 1-1/4 inch above the bell's lower edge or 1/4 inch above the gong's lower edge. Excess tapper bar must then be removed by cutting it below the lower securing nut.

(d) Replacement Criteria. In general, tapper balls should be replaced at each overhaul. However, if the tapper ball is in good condition it may be rotated 180 degrees and used for one more deployment. Other tapper components shall be replaced if:

1. The tapper bar is broken or severely bent.

2. The swing rod is worn to 1 inch or less.

3. The swing rod sleeves are worn to a 1/16 inch thickness.

p. Painting.

(1) Buoys. Buoys shall be painted in accordance with the *Coatings and Color Manual* COMDTINST M10360.3 (series). When painting buoys, refer to Table 2-11 of this chapter for standard waterlines (the line between the color coat and the antifouling paint). Color and marking shall be in accordance with Chapter 3 of this manual.

(2) Buoy Appendages. All buoy appendages below the lantern including bell stands, battery boxes, gong stands, tappers, etc. shall be painted with a neutral topcoat color such as gray. Stainless steel and aluminum appendages above the lantern such as topmark stands and solar panel frames shall remain unpainted. Steel appendages above the lantern shall be galvanized or painted with a neutral topcoat color such as gray.

2.E.4.p.(2).

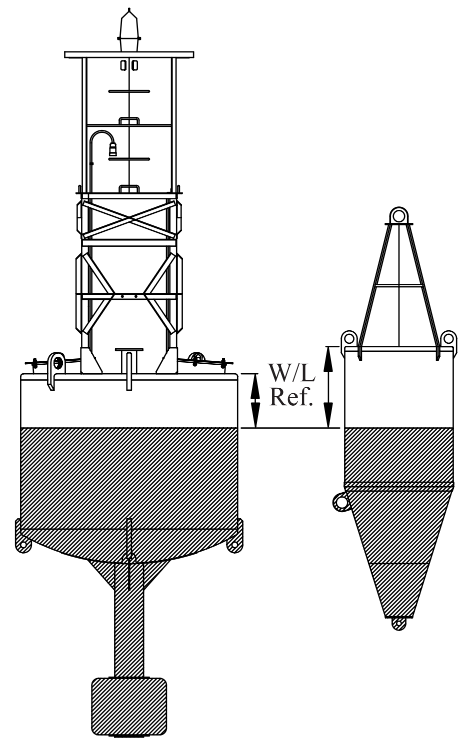


Table 2-11

STANDARD WATERLINES FOR STEEL BUOYS

Noted below are the standard waterlines which will be indicated on new steel buoys (line between color coat and antifouling paint). Used buoys should have the same waterlines except when used in areas where the buoy may ride much lower or higher than normal.

STD Buoy Type	W/L (in.)	STD Buoy Type	W/L (in.)
9X35 LWR	24	2NR/2CR	36
9X32 LR	30	3NR/3CR	24
9X20 R	18	3NI	60**
8X26 LR	24	3CI	54**
8X26 LWR	24	4NR/4CR	24
8X21 LR	24	5NR/5CR	24
7X20 LI	*	5CI	33**
7X17 LR	18	5NI	46**
6X20 LR	18	6NR/6CR	18
5X11 LR	12	6CT	24**
3.5X8 LR	9	6NT	40**
1NR/1CR	60	FOAM BUOYS	***

*Located at Largest Diameter
**Measured from Top Horizontal Surface
***Located half way between the top and bottom of the buoy hull (flotation foam)

2.F. Foam Buoys. The entire "family" of foam buoys was redesigned in 1996. The buoys now have a more robust structural framework, the lifting eyes are larger and stronger, the mooring eyes are similar in size to the equivalent steel buoy, and all assembly hardware is made of corrosion-resistant stainless steel. The color pigments and antioxidant additives in the foam have been increased to reduce fading. The new designs are sized to provide the same visual signal to the mariner as the equivalent class of steel buoy. However, foam buoys have a significantly higher life cycle cost than steel buoys. Foam buoys should only be used when there is a clear operational reason that makes them preferable to steel. An example would be a station where switching from steel to foam will permit changing the servicing platform from a buoy tender to a buoy boat. Also, foam buoys are generally not suitable for rugged environments, and should never be used in ice conditions. Foam buoys are designed to remain on station for eight years with minimal maintenance required. They may be kept on station beyond eight years if they remain serviceable and continue to provide the required signal.

1. Assembly of New Buoys. Foam buoys are shipped either unassembled or partly assembled, depending on the buoy type. Assembly instructions are included in the data sheets for each buoy type. In general, the following guidelines apply:

    a. Upon receipt of new buoys, inspect for shipping damage and ensure all parts are accounted for.

    b. The middle and bottom plates on new buoys are sometimes warped during the manufacturing process. This should not affect assembly of the buoy or its performance on station.

    c. Assemble the buoys as soon as possible so that the parts are not lost.

    d. Ensure that all connections are tightly secured. On the smaller buoys, the nuts shall be tightened until the metal plates are compressed at least 1/2 inch into the foam or until the elastic lock nuts ("Nylock") bottom out on the threads.

    e. Always use new stainless steel elastic lock nuts to assemble the buoys. These nuts shall not be reused if they have been backed off. Once they have been tightened, do not loosen them.

2. Servicing. Foam buoys have been designed to require minimal servicing while on station. The following guidance applies:

    a. Check for any loose connections and tighten if possible.

    b. Use a pressure wash or scrub brush to remove growth, guano, etc.

2.F.2. c. Do not paint the foam hulls or daymarks. Fading of the foam will eventually occur (usually late in the service life), so deploy new buoys as soon as possible rather than letting them sit on the pier.

d. Buoys should not be relieved because of minor "cosmetic" damage. They should only be relieved if damaged metal or foam parts affect the operational performance or safe handling of the buoy. Minor repairs to the foam parts and metalwork may be carried out at the unit's discretion.

e. Replacement of major components with new parts may be done at the unit's discretion. Foam hulls, daymarks, and "metal sets" (the structural framework of the buoy) are available on commercial contract and can be ordered with unit funding through Commandant (G-SEC-2). In addition, salvaged parts from other buoys can be used to replace damaged parts and extend the life of the buoy.

f. The extensive metalwork on the 5x9 buoy, particularly the tower, might require maintenance painting during the service life of the buoy to repair significant damage to the coating system or to maintain the daytime signal. Refer to the *Coatings and Color Manual* COMDTINST M10360.3 (series) for guidance on materials, safety, and application instructions. Follow the guidance for "steel ocean buoys" for shoreside maintenance painting. Follow the guidance for "foam buoys" for on-station touch-up painting.

3. Disposal. Buoys shall be disposed of in accordance with Federal, state, and local regulations.

G. Plastic Buoys. A new plastic buoy was designed 1996. This new buoy replaces the old 5th and 6th class plastic "QPL" buoys. The old plastic buoys are still authorized for use but are no longer available for purchase. The new plastic buoys are designed to be kept on station for as long as they remain serviceable and continue to provide the required signal.

1. Servicing. Plastic buoys have been designed to require minimal servicing while on station. The following guidance applies:

a. Check the lifting eye and mooring eyes for loose connections and tighten if possible.

b. Check the watertight integrity of the "spin patches" on the buoy top head. Buoys with "spin patches" that have lost their watertight integrity shall be relieved.

2.G.1. c. Use a pressure wash or scrub brush to remove growth, guano, etc.

d. Do not paint the buoys. Fading of the plastic will eventually occur (usually late in the design life), so deploy new buoys as soon as possible rather than letting them sit on the pier.

e. Buoys should not be relieved because of minor "cosmetic" damage. They should only be relieved if the watertight integrity of the plastic shell is compromised or if there is damage to the lifting or mooring eyes.

2. Disposal. Plastic buoys shall be disposed of in accordance with Federal, state, and local regulations.

H. River Buoys. Steel river buoys are filled with polyurethane foam. This foam emits a toxic gas when burned. Therefore, welding repairs to river buoy bodies are not permitted. High pressure water wash of the entire buoy (above and below the waterline) is recommended to remove guano, "buoy critters", dirt, salt, etc. Touch-up painting is not recommended for "cosmetic" reasons. Touch-up painting should only be done to repair significant damage to the topcoat. If touch-up painting is performed, follow the guidance in the *Coatings and Color Manual* COMDTINST M10360.3 (series) for materials, safety, and application instructions.

I. Buoy Outfitting. Communication between the maintenance facility and the servicing unit is critical to ensure that the buoy is properly outfitted for its intended station.

1. Maintenance Facility. Before delivery to the servicing unit, the maintenance facility shall outfit the buoy with the following equipment (as applicable):

a. Wiring as specified by the servicing unit (i.e., for one or both pockets or a solar battery box).

b. Solar battery box.

c. Sound signals.

d. New gaskets for solar battery boxes and battery pockets.

2. Floating Units. The servicing unit shall outfit the buoy with the following equipment (as applicable) and **conduct an initial air test on the pockets before the buoy is deployed**:

a. Lantern and light equipment.

2.I 2.

b. Solar panels and frame.

c. Topmark.

d. Batteries.

e. Vent valves.

f. Racon or other special equipment.

g. Retroreflective material.

h. If necessary, a ballast slug should be placed in the opposite pocket to compensate for either primary or secondary batteries.

i. Mooring.

J. Scheduled Servicing Visits. Routine visits, mooring inspections, battery recharge visits, and buoy reliefs are discussed below and in the *Aids to Navigation Manual Administration* COMDTINST 16500.7 (series). Bringing the buoy on deck **shall be avoided** except as required for inspection of moorings, relocation, relief, recharge, or correction of a discrepancy.

1. Routine Visits. The primary purpose of this visit is to position check the buoy and ensure the correct operation of the signal hardware. However, this visit also provides a good opportunity to inspect the condition of the buoy above the waterline. Servicing units shall perform the following inspections during routine visits. Repairs shall be made as required.

a. Lighting Equipment. All lighting equipment (lamps, flashers, lampchangers, daylight controls, and lanterns, etc.) shall be inspected using Chapter 6 of this manual and the *Short Range Aids to Navigation Servicing Guide* COMDTINST 16500.19 (series) for guidance.

b. Solar Panels. Solar panels shall be inspected using Chapter 10 of this manual and the *Short Range Aids to Navigation Servicing Guide* COMDTINST 16500.19 (series) for guidance.

c. Wiring. All accessible wiring shall be visually checked for cracking, deterioration, and corrosion. Wire retaining clips shall be checked to ensure that the wire is secure. Stuffing tubes shall be inspected.

2.J.1. d. Batteries. Batteries shall be load tested at the lantern using Chapter 10 of this manual and the *Short Range Aids to Navigation Servicing Guide* COMDTINST 16500.19 (series) for guidance.

e. Retro. Any retroreflective material which is peeling or faded shall be replaced as outlined in Chapter 3 of this manual.

f. Vent Valves. The vent valves shall be inspected to ensure that the balls are free to move. (Data Sheet 2.L.2)

g. Topmarks. Repair or replace topmarks and mounting hardware as necessary. (Data Sheets 2.L.18 through 2.L.21)

h. Buoy Battery Boxes. Battery boxes shall be inspected for damaged flanges, covers, gaskets, vent valves, and securing hardware. Air testing is not required. (Data Sheet 2.L.15)

i. Tappers. Tapper hinges shall be checked for wear and free movement. (Data Sheet 2.L.10)

j. Bells and Gongs. Bells, gongs, and mounting equipment shall be inspected for wear, cracks, excessive rust, missing shock pads, and loose hardware. (Data Sheets 2.L.6 through 2.L.9)

k. Whistles. The ball valves on whistles shall be checked for free operation and cleaned of salt and dirt. (Data Sheets 2.L.4 and 2.L.5)

l. Towers. The tower legs and feet shall be inspected for cracks and broken welds.

m. Battery Pockets. Battery pocket closures shall be inspected for damaged flanges, covers, swingbolts, and gaskets, and repaired if possible. (Data Sheets 2.L.11 through 2.L.14) **All repaired battery pocket closures shall be air tested before redeployment in accordance with paragraph 2.E.4.m.(2).** If pockets are not damaged, but need to be opened for any reason, follow the air testing guidance listed below. Care shall be taken when tightening the swing bolts. Overtightening the swing bolts could crack the gasket, which would compromise the watertight integrity of the battery pockets.

(1) **When standard 6 swing bolt or non-standard 12 swing bolt battery pockets are opened, air tests on these pockets are not required.** However, air tests may be performed at the Commanding

Officer's discretion if on-station conditions warrant; for example, when buoys are frequently awash.

(2) **Buoys with V-band or bolted flange pocket closures shall be air tested after being opened.** If a servicing unit is unable to perform the required air test, V-band or bolted flange battery pocket closures shall not be opened. In this case, buoys requiring recharge shall be "hotpacked."

2. Mooring Inspections. As the name implies, the purpose of this inspection is to ensure that the buoy and mooring hardware will last until the next scheduled mooring inspection. Because this inspection requires that the buoy be brought on board, it also provides an opportunity for a thorough examination of the buoy, particularly the underwater portion. If a buoy is damaged or deteriorated beyond the servicing unit's repair capabilities, it shall be relieved immediately or its relief date adjusted as required. In addition to the inspections required for routine visits listed in paragraph 2.J.1 above, servicing units shall perform the following mooring and buoy hull inspections.

a. Chain. A chain mooring consists of three parts: the riser chain, the chafe section, and the bottom chain (see Figure 2-3). At a minimum, the entire chafe section of the mooring shall be brought on deck and inspected. Depending on the length of time between mooring inspections and the severity of environmental conditions, it may be prudent to bring the entire mooring (including the sinker) on board. When inspecting chain, it is important to know its condition at the time of the last mooring inspection. Annual wear rates for a given buoy station can be estimated by keeping records of the chain measurements at each inspection. The chafe section of the chain is likely to show the greatest wear. (Data Sheet 2.M.1)

(1) Inspection. Inspect for wear by measuring the smallest parts of the most worn links, using a caliper. Regardless of the original chain size used on a given buoy, the chain need not be replaced until it has reached the minimum chain wear measurement for that buoy type. Minimum chain wear measurements for each buoy are provided in Table 2-12. The chain shall be replaced if it is worn to the minimum wear measurement, or if it will reach this point before the next scheduled mooring inspection (based on annual wear rates). Any chain that is deformed, stretched, bent, or twisted shall be replaced.

(2) Chain Conservation. **All efforts shall be made to conserve chain to the maximum extent possible.** Each mooring has to be evaluated on a case by case basis to determine the best course of action, and

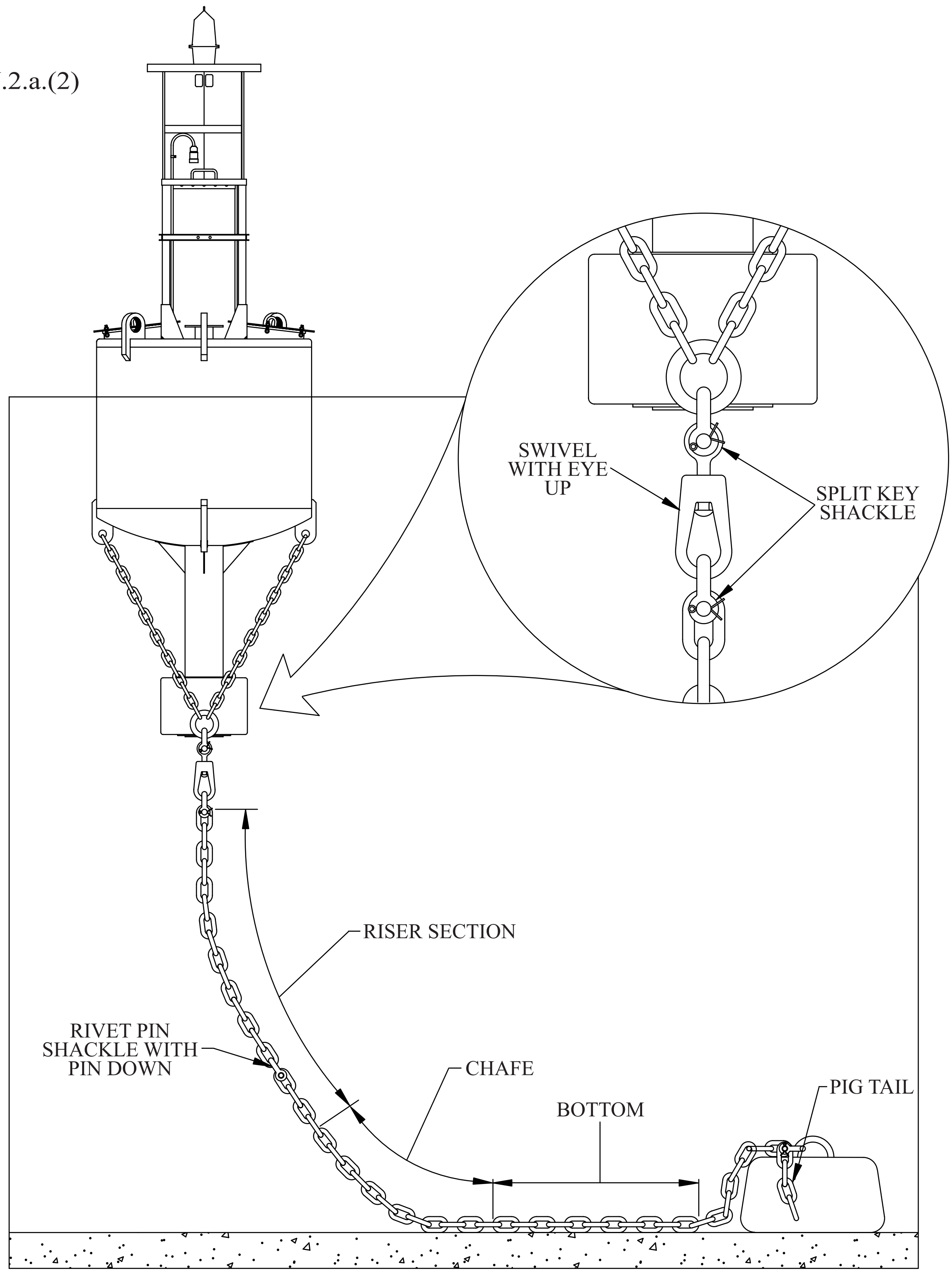


Figure 2-3
MOORING CONFIGURATION

2.J.2.a.(2) accurate record keeping is vital to assist in this process. At the Commanding Officer's discretion, units may utilize one or more of the following methods for chain conservation.

(a) Extend mooring inspection intervals. All units should aggressively pursue extending mooring inspection intervals beyond two years. The use of larger chain sizes in the chafe (or in the entire mooring) is highly recommended to increase servicing intervals and reduce chain consumption. Guidelines for extending mooring inspection intervals can be found in the *Aids to Navigation Manual-Administration* COMDTINST M16500.7 (series).

(b) Cropping chain. When replacing sections of worn chain, care should be taken to minimize the amount of chain that is replaced by following the wear measurement guidance in Table 2-12. However, enough chain should be removed on either side of the worn section to ensure the shackles do not ride in the chafe when the replacement chain is connected to the mooring. If a mooring has sufficient scope and only a short section of chain is worn, it may be possible to remove the worn section and join the riser and bottom section without replacing any chain. In this case, remove enough of the chain above the worn section to ensure the shackle does not ride in the chafe when the sections are connected together (see 2.J.2.c.(2)).

(c) End-for-end. If conditions warrant, either the entire mooring or certain sections of chain can be cut and end-for-ended. This method can be utilized where chain is worn but not to the extent that it needs to be replaced. This action will put "good" chain in the chafe section and shift the worn chain to an area of less wear.

(d) Chain downgrading. Chain that is worn below the useable diameter for a given buoy type may be "downgraded" and used on a buoy that requires a smaller size chain.

b. Bridles. Inspect for wear by measuring the smallest parts of the most worn links, using a caliper. Any bridles that have links which are deformed, stretched, bent, or twisted shall be replaced. When a buoy hull is relieved, the bridle shall be removed and evaluated. If the bridle has not reached the minimum wear measurement for the comparable chain size, the bridle shall be

2.J.2.b.

Table 2-12

ACCEPTABLE MOORING CHAIN SIZES AND MINIMUM CHAIN WEAR MEASUREMENTS FOR VARIOUS BUOY TYPES

Bouy Type	Acceptable Mooring Chain				Minimum Wear Measurement
9X35LWR	1-7/8"	1-3/4"	1-5/8"	1-1/2"	1-1/16"
9X32LR	1-7/8"	1-3/4"	1-5/8"	1-1/2"	1-1/16"
9X20R	1-1/2"	1-1/4"			7/8"
8X26LR	1-1/2"	1-1/4"			7/8"
8X26LWR	1-1/2"	1-1/4"			7/8"
8X21LR	1-1/2"	1-1/4"	1-1/8"		25/32"
7X20LI	Use Existing Mooring From Permanent Buoy				
7X17LR	1-1/2"	1-1/4"	1-1/8"	1"	23/32"
6X20LR	1-1/2"	1-1/4"	1-1/8"	1"	23/32"
5X11LR	1-1/4"	1-1/8"	1"		23/32"
5X9LFR	1"	7/8"	3/4"		1/2"
3.5X8LR	1"	7/8"	3/4"		1/2"
1CR	1-1/2"	1-1/4"	1-1/8"		25/32"
1NR	1-1/2"	1-1/4"	1-1/8"		25/32"
2CR	1-1/4"	1-1/8"	1"	7/8"	23/32"
2NR	1-1/4"	1-1/8"	1"	7/8"	23/32"
3CR	1"	7/8"	3/4"		1/2"
3NR	1"	7/8"	3/4"		1/2"
3CI	1"	7/8"	3/4"		1/2"
3NI	1"	7/8"	3/4"		1/2"
5CR	1/2"				11/32"
5NR	1/2"				11/32"
5CI	1/2"				11/32"
5NI	1/2"				11/32"
2CFR	1-1/8"	1"	7/8"	3/4"	1/2"
2NFR	1-1/8"	1"	7/8"	3/4"	1/2"
3CFR	7/8"	3/4"	1/2"		11/32"
3NFR	7/8"	3/4"	1/2"		11/32"
4CFR	3/4"	1/2"			11/32"
4NFR	3/4"	1/2"			11/32"
5CFR	1/2"				11/32"
5NFR	1/2"				11/32"
6CFR	1/2"				11/32"
6NFR	1/2"				11/32"
FWCFR	1/2"				11/32"
FWNFR	1/2"				11/32"
5CPR	1/2"				11/32"
5NPR	1/2"				11/32"

Example: A 9X20BR can be moored with either 1-1/2" or 1-1/4" chain. The mooring must be replaced on a 9X20BR if the chain is worn to 7/8" or if it will reach 7/8" before the next scheduled mooring.

2.J.2.b. cleaned and retained on board for further use. In general, a bridle should last through at least two buoy hull deployments. (Data Sheet 2.M.2)

c. Shackles.

(1) Split-Key. Split-key shackles shall only be used to connect the bridle to the buoy, the swivel to the bridle, the riser to the swivel, and the mooring chain to the sinker. Split-key shackles **shall not** be used to connect lengths of chain. When connecting the swivel to the bridle, ensure that the head of the shackle pin lies toward the buoy counterweight to reduce wear. See Figure 2-3. (Data Sheet 2.M.3)

(2) Rivet-Pin. Rivet-pin shackles ("heat and beat") are used to connect lengths of chain. Install the shackle with the pin toward the sinker to prevent catching the "horse collar" during mooring retrieval. **Rivet-pin shackles shall not be used in the chafe section of the mooring.** When removing a rivet pin shackle to replace a section of mooring chain, cut the shackle pin instead of the shackle body. This will conserve the shackle body for future use and will only require replacement of the less expensive shackle pin. (Data Sheet 2.M.3)

d. Swivels. Worn or seized swivels shall be replaced. Swivels are mounted between the bridle and the riser chain with the round eye toward the bridle. If the mooring is prone to knotting an additional swivel can be used further down in the riser section of the mooring. **However, swivels shall not be used in the chafe section of the mooring.** (Data Sheet 2.M.4)

e. Sinker. The sinker shall be replaced if the bail is worn to less than 1/2 of its original diameter, or the concrete is eroded or broken away. Sinker bails shall be made from steel bar stock. **Sinkers with bails made from buoy chain shall be replaced.** (Data Sheet 2.M.5) "Dor-Mor" cast iron sinkers are authorized for small unlighted buoys. (Data Sheet 2.M.6)

f. Hull. Buoys shall be checked for flooding, inspected for damage that could affect their watertight integrity, and repaired if possible. Any time structural repairs are performed on the buoy hull, **an air test shall be performed** in accordance with paragraph 2.E.4.m.(1). When performing hot work on the buoy hull, follow the safety guidance listed below:

(1) **If hot work is required in the vicinity of the battery pockets or near vent lines or vent valves, remove the battery pocket covers and batteries prior to beginning hot work.**

(2) Cutting. If a buoy hull is completely or partially full of water (i.e., when recovering a sunken buoy or a buoy riding low in the water), exothermic or oxy/acetylene equipment may be used to cut a hole and drain the water. The general procedure would be to cut a hole in the lowest part of the hull that is practical to reach. In this case, there would be water opposite to the hot work, so gas-freeing of the hull is not required.

(3) Welding. Welding is sometimes required to repair a cracked seam or gusset, etc. on the buoy hull. Before beginning, first remove the buoy body air test cap to allow the release of any pressure that might build up from the heat of the welding process; then follow the guidelines in paragraph (4) below for gas-free testing.

(4) Gas-Free Testing. Be aware that combustible gases could be present in the buoy hull. Before beginning hot work, the hull shall be tested using a combustible gas monitor or explosive meter. Insert the probe from the meter into the buoy body air test fitting.

(a) If no combustible gases are detected, then hot work can be performed on the buoy.

(b) If combustible gases are detected, the buoy hull shall be gas-freed before hot work is performed. This is not easily done in the field. If it is critical that the buoy be repaired on station, the buoy hull can be purged with compressed air to displace the combustible atmosphere. If the hull is equipped with two air test fittings (see paragraph 2.E.4.m), ensure that both fittings are open to improve the air flow. If it is not critical that the buoy be repaired on station, return it to the buoy maintenance facility with a warning concerning the detection of combustible gases.

g. Appendages. Swing arms, mooring pins, and mooring eyes shall be inspected for excessive wear and repaired if possible.

h. Towers. The tower legs and feet shall be inspected for cracks and broken welds and repaired if possible.

i. Battery Pockets. Battery pocket closures shall be inspected for damaged flanges, covers, swingbolts, and gaskets, and repaired if possible. (Data sheets 2.L.11 through 2.L.14) **All repaired battery pocket closures shall be air tested before redeployment in accordance with paragraph 2.E.4.m.(2).** If

2.J.2.i. pockets are not damaged, but need to be opened for any reason, follow the air testing guidance listed below. Care shall be taken when tightening the swing bolts. Overtightening the swing bolts could crack the gasket, which would compromise the watertight integrity of the battery pockets.

(1) **When standard 6 swing bolt or non-standard 12 swing bolt battery pockets are opened, air tests on these pockets <u>are not required</u>.** However, air tests may be performed at the Commanding Officer's discretion if on-station conditions warrant; for example, when buoys are frequently awash.

(2) **Buoys with V-band or bolted flange pocket closures <u>shall be air tested</u> after being opened.** If a servicing unit is unable to perform the required air test, V-band or bolted flange battery pocket closures shall not be opened. In this case, buoys requiring recharge shall be "hotpacked."

j. <u>Buoy Battery Boxes</u>. Battery boxes shall be inspected for damaged flanges, covers, swingbolts, gaskets, and vent valves and repaired if possible. Do not air test the buoy battery box. (Data Sheet 2.L.15)

k. <u>Vent Valves</u>. The vent valves shall be inspected to ensure that the balls are free to move and the o-rings seat with the PVC reducers. Repair or replace as necessary. (Data Sheet 2.L.2)

l. <u>Bells and Gongs</u>. Mounting equipment for bells and gongs shall be inspected for cracks, excessive rust, missing shock pads, and loose hardware; repair or replace if possible. Bells and gongs which are excessively worn shall be rotated. (Data Sheets 2.L.6 through 2.L.9)

m. <u>Tappers</u>. Tapper hinges shall be checked for wear and free movement. Tapper balls that are worn shall be rotated or replaced. (Data Sheet 2.L.10)

n. <u>Whistles</u>. The ball valves on whistles shall be checked for free operation and cleaned of salt and dirt. The air gap on the whistle bell shall be adjusted to $15/16 \pm 1/16$ inch. (Data Sheets 2.L.4 and 2.L.5)

o. <u>Wiring</u>. All accessible wiring shall be visually checked for cracking, deterioration, and corrosion and shall be replaced as necessary. Wire retaining clips and stuffing tubes shall be repaired or replaced as necessary

2.J.2.p p. Coating. Coating repair on station is described in the *Coatings and Color Manual* COMDTINST M10360.3 (series).

(1) Cleaning. Heavy marine growth and "buoy critters" should be removed by scraping. Care shall be taken when scraping so as not to damage the buoy's coating system. In particular, the ablative antifouling paint used below the waterline is relatively "soft" and can be removed by aggressive scraping. High pressure water wash is recommended to remove guano, slime, and salt.

(2) Topcoat Paint. Touch-up painting should be minimized, and it should not be done for strictly "cosmetic" reasons. However, if the paint has faded or if scraping and high pressure water wash are ineffective in removing guano, then touch-up painting can be done to restore the proper color. If touch-up painting is performed, refer to the *Coatings and Color Manual* COMDTINST M10360.3 (series) for guidance on materials, safety procedures, and application methods.

3. Battery Recharge Visit. Battery recharging cycles shall coincide with routine visits, mooring inspections, or reliefs to the maximum extent possible. Batteries shall be replaced as outlined in Chapter 9 of this manual. **When standard 6 swing bolt or non-standard 12 swing bolt battery pockets are opened, air tests on these pockets are not required.** However, air tests may be performed at the Commanding Officer's discretion if on-station conditions warrant; for example, when buoys are frequently awash. **Buoys with V-band or bolted flange pocket closures shall be air tested after being opened.** If a servicing unit is unable to perform the required air test, V-band or bolted flange battery pocket closures shall not be opened. In this case, buoys requiring recharge shall be "hotpacked." Care shall be taken when tightening the swing bolts. Overtightening the swing bolts could crack the gasket, which would compromise the watertight integrity of the battery pockets.

4. Buoy Relief. As outlined in the *Aids to Navigation Manual-Administration* COMDTINST 16500.7 (series), buoy relief cycles should be extended where possible.

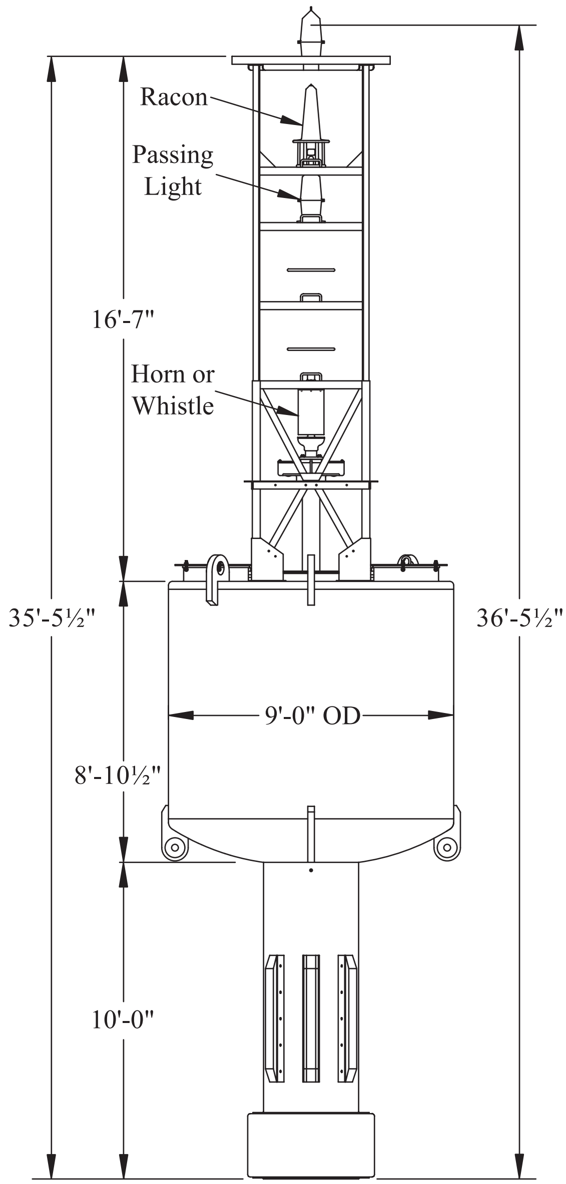
a. Removal of Fouling. Servicing units shall remove the majority of fouling to the greatest extent possible before transferring the buoys to the shoreside buoy maintenance facility. Fouling shall also be removed from underneath the counterweights of flat-bottom buoys and from inside the tubes of whistle buoys.

b. Removal of Components. Remove the following items from buoys before transferring the buoys to the shoreside buoy maintenance facility: batteries, battery racks, racons, horns, junction boxes, vent valves, lighting equipment, solar panels, solar panel stands, topmarks, and bridles.

2.K. General Description Data Sheets - Buoys. The general description data sheets for buoys are presented in this section. The function, physical characteristics, related equipment, operational characteristics, and reference documents are listed for each standard buoy type. The steel buoys are listed first, followed by the foam buoys and the plastic buoys. The non-standard steel buoy configurations and reference documents are given as well.

2.K. 1. 9X35LWR. The 9X35LWR is designed and constructed for the most exposed locations. It has an open counterweight tube to accomodate a whistle, horn, or wave turbine generator (WTG). The tower can accomodate a racon, flashtube, and passing light. Mounting holes are provided at the base of the tower for solar panels.

a. Standard Buoy Arrangements. 1987 Type 9X35LWR, 9X35LR, 9X35LHR.



Physical Characteristics. (no mooring)

Buoy Weight	18,500 lbs.
Buoy Draft	15 ft. 10 in.
Focal Height of Light (upr)	20 ft. 7 in.
Focal Height of Light (lwr)	15 ft. 8 in.
Freeboard	3 ft.
Minimum Freeboard	1 ft. 2 in.
Pounds per inch Immersion	300

Related Equipment.

Whistle	4-Ball
Horn	SA-850
Mooring Bridle	1-1/2 in x 20 ft.
Mooring Chain	1-1/2 in.
Sinker (concrete)	12,750 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	3.2 nm
Radar Range (w/o Racon)	4.0 nm
Mooring Depth (min.)	35 ft.

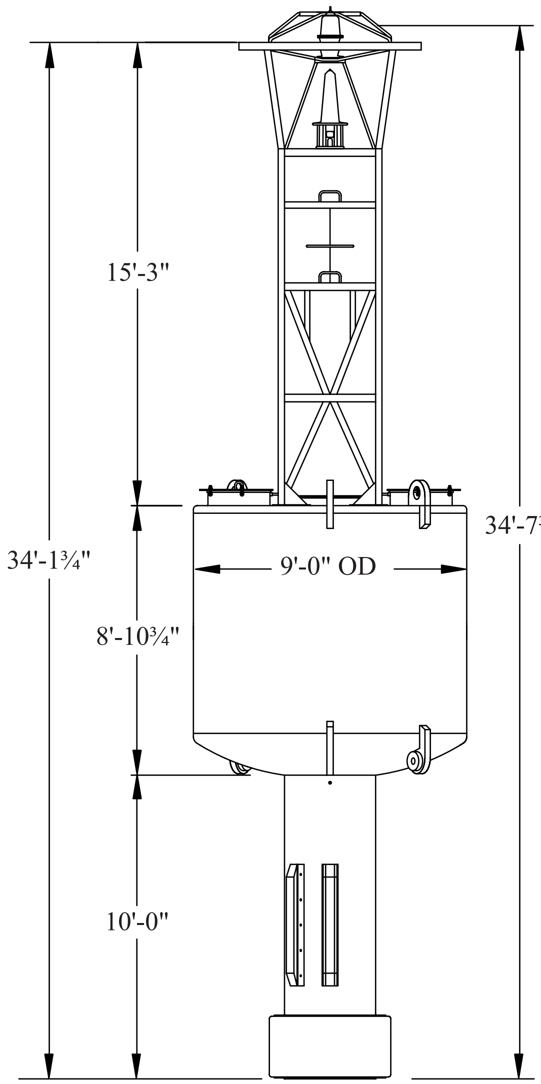
Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1-7/8"	127'
1-3/4"	144'
1-5/8"	165'
1-1/2"	191'

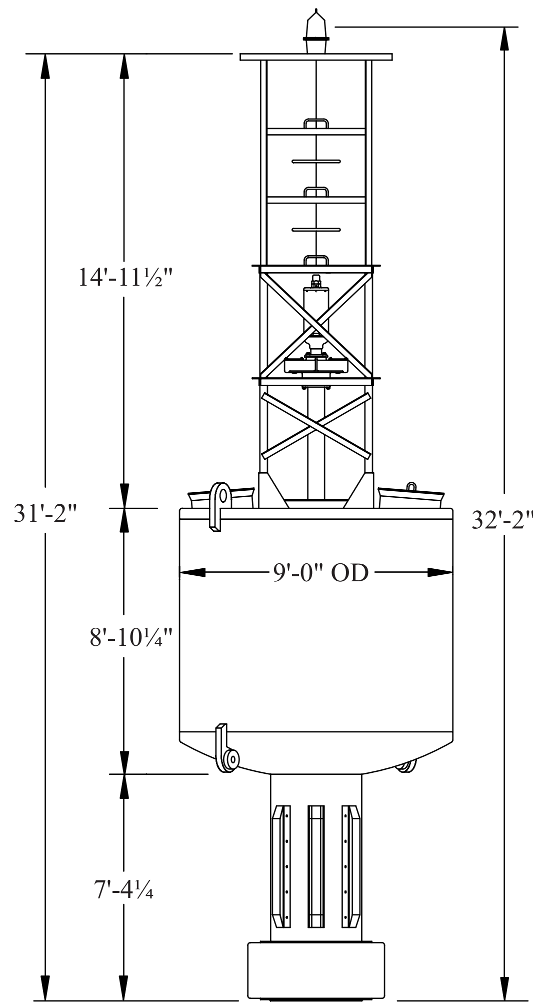
Reference Documents. (use latest rev.)
G-SEC Drawing No. 121151
G-SEC Specification No. 464

Data Sheet 2.K.1. 9X35LWR Buoy.

2.K.1. b. Non-Standard Buoys. The 1983 type 9X35LHR buoy is designated an Exposed Location Buoy (ELB). This buoy was designed for weather gathering using equipment supported by the National Data Buoy Center. It is configured to accept a WTG but can be refitted for a whistle with minor modifications. Its tower has pipe legs for cables and venting.



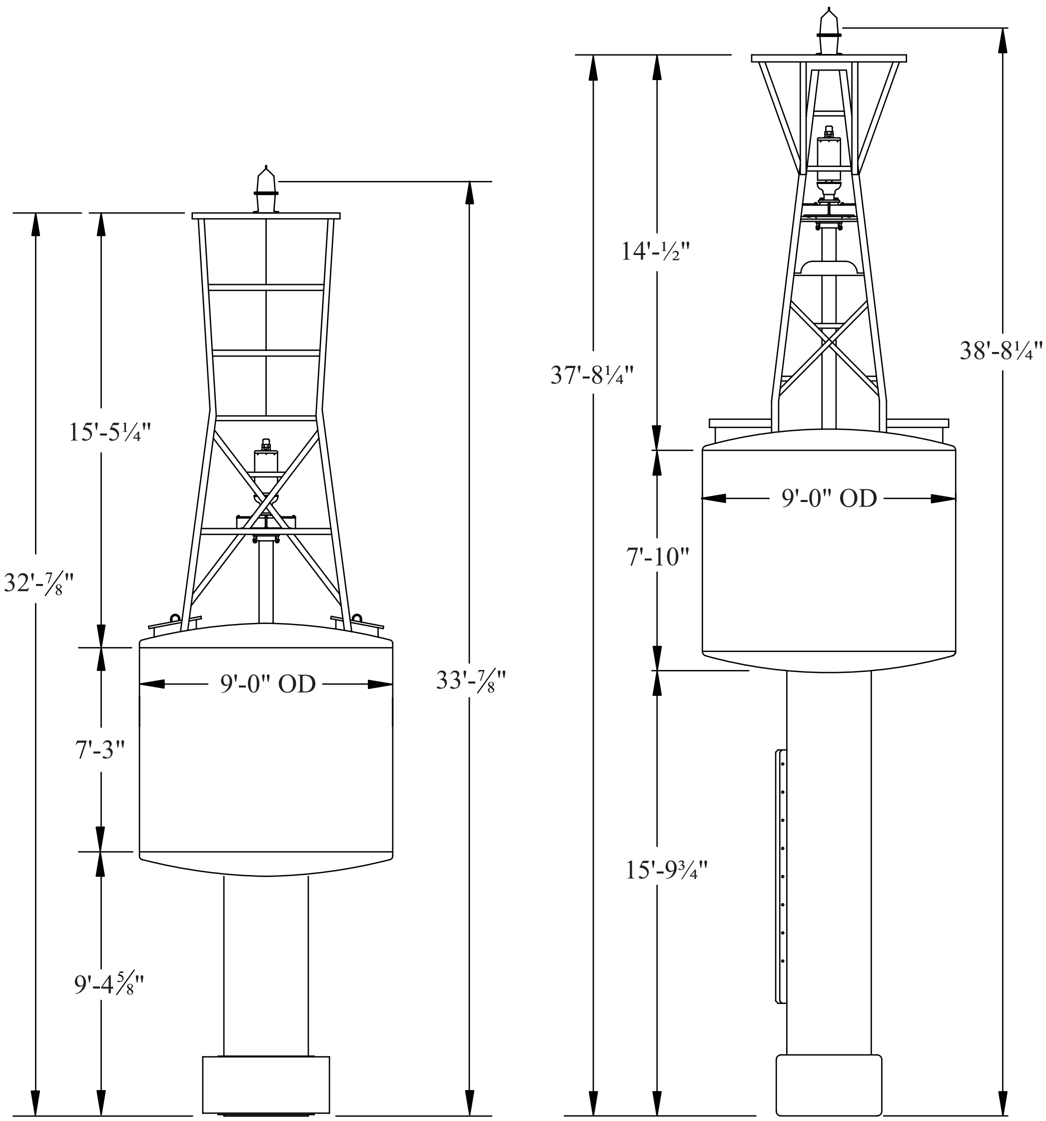
1983 TYPE
9X35LHR (ELB)
WEIGHT: 17,700 LBS
DRAWING: 121048



1962 TYPE
9X32LWR
WEIGHT: 18,616 LBS
DRAWING: 107326

Data Sheet 2.K.1. (cont'd).

2.K.1. b. <u>Non-Standard Buoys</u>.



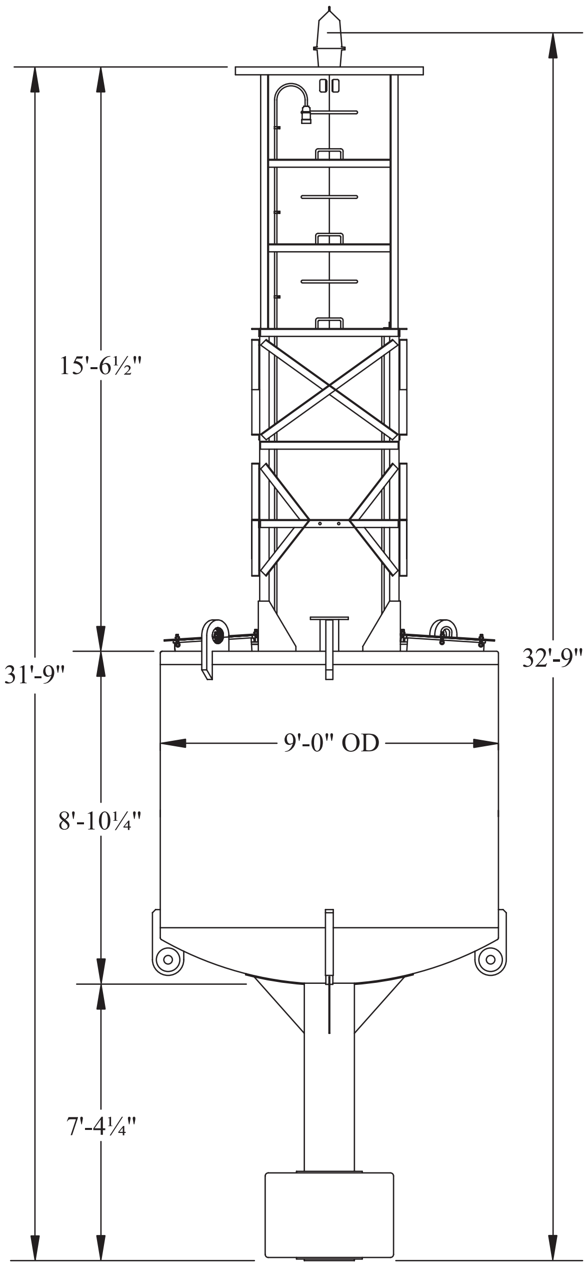
1952 TYPE
9X35LWR
WEIGHT: 18,800 LBS
DRAWING: BU-52-12

1942 TYPE
9X38LW
WEIGHT: 19,050 LBS
DRAWING: BU-41-146

Data Sheet 2.K.1. (cont'd).

2.K. 2. 9X32LR. The 9X32LR is designed and constructed for the most exposed locations. It is designed for use as a lighted buoy and can be fitted with a bell, gong, or horn.

a. Standard Buoy Arrangements. 1989 (1962) Type 9X32LR, 9X32LBR, 9X32LGR, 9X32LHR.



Physical Characteristics. (no mooring)

Buoy Weight	17,500 lbs.
Buoy Draft	11 ft. 7 in.
Focal Height of Light	21 ft. 2 in.
Freeboard	4 ft. 7 in.
Minimum Freeboard	1 ft. 10 in.
Pounds-Per-Inch Immersion	340

Related Equipment

Bell	225 lbs.
Gong	3 ea. 20 in.
Horn	SA-850
Mooring Bridle	1-1/2 in. x 18 ft.
Mooring Chain	1-1/2 in.
Sinker (concrete)	12,750 lbs.

Operational Characteristics. (nominal)

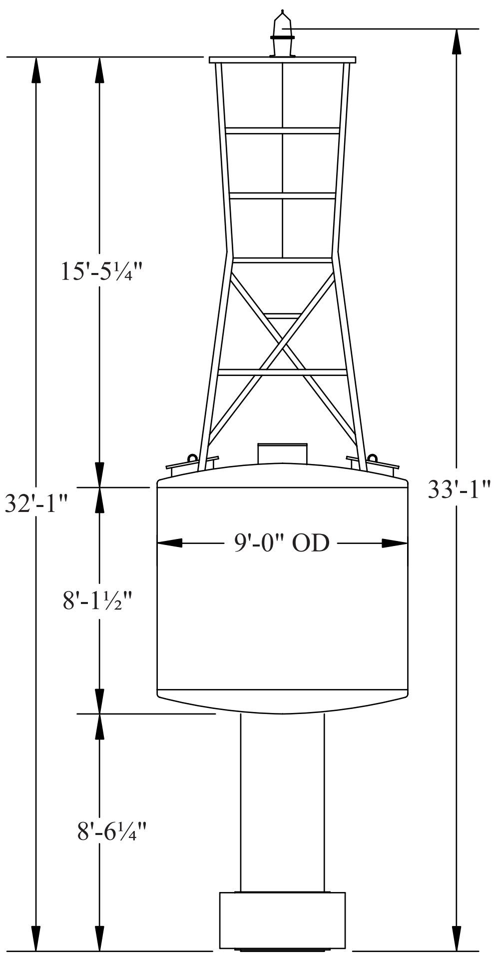
Daymark Visual Range	3.8 nm
Radar Range	4.5 nm
Mooring Depth (min.)	30 ft.

Maximum Mooring Depth.

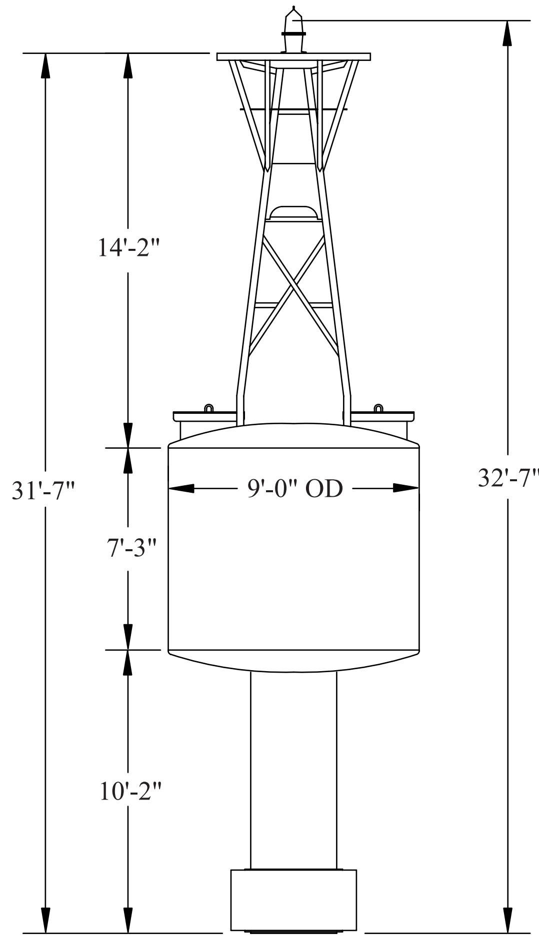
Chain Size	Max Mooring Depth
1-7/8"	217'
1-3/4"	248'
1-5/8"	285'
1-1/2"	332'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121132 (107326)
G-SEC Specification No. 464

Data Sheet 2.K.2. 9X32LR Buoy.



1952 TYPE
9X32LR
WEIGHT: 18,000 LBS
DRAWING: BU-52-12
DRAWING: BU-50-12 (LB)
DRAWING: BU-50-13 (LG)

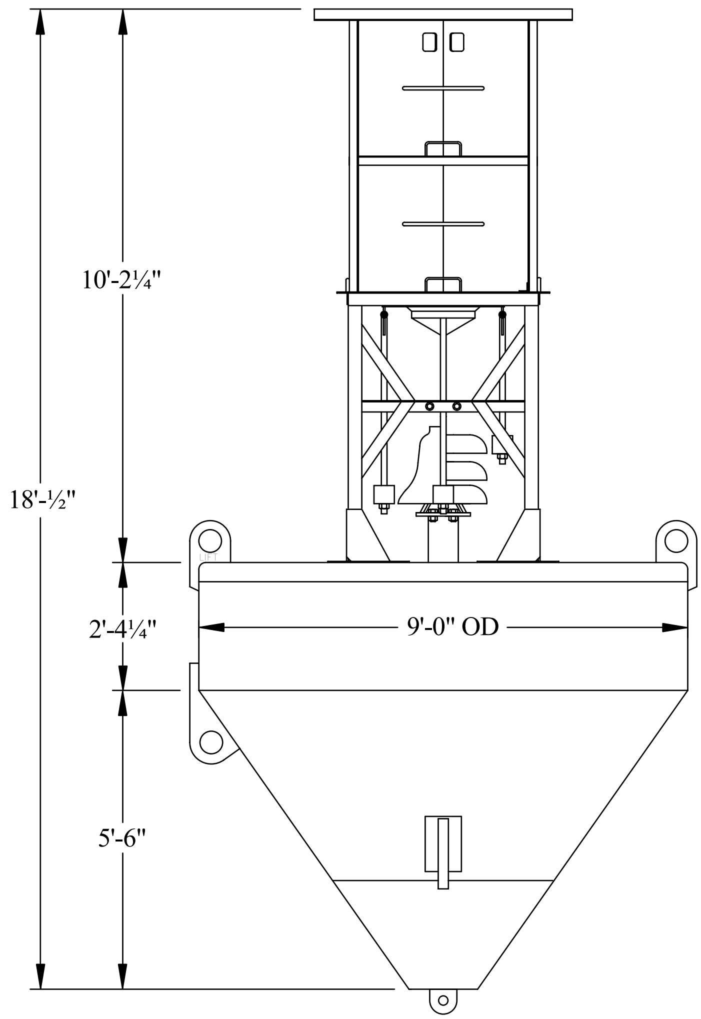


1942 TYPE
9X32L
WEIGHT: 22,000 LBS
DRAWING: BU-43-06 (Bell)
DRAWING: BU-43-31(Gong)

Data Sheet 2.K.2. (cont'd).

2.K. 3. 9X20BR/GR. The 9X20BR/GR is designed and constructed for use as a wave-activated bell or gong sound signal buoy where lighting is not required.

a. Standard Buoy Arrangements. 1962 Type 9X20BR, 9X20GR.



Physical Characteristics. (no mooring)

Buoy Weight	8,000 lbs.
Buoy Draft	5 ft. 4 in.
Freeboard	2 ft. 6 in.
Minimum Freeboard	12 in.
Pounds-Per-inch Immersion	340

Related Equipment.

Bell	225 lb.
Gong	3ea. 20 in.
Mooring Bridle	1-1/4 in. x 15 ft.
Mooring Chain	1-1/4 in.
Sinker (concrete)	8,500 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	3 nm
Radar Range	3.7 nm
Mooring Depth (min.)	15 ft.

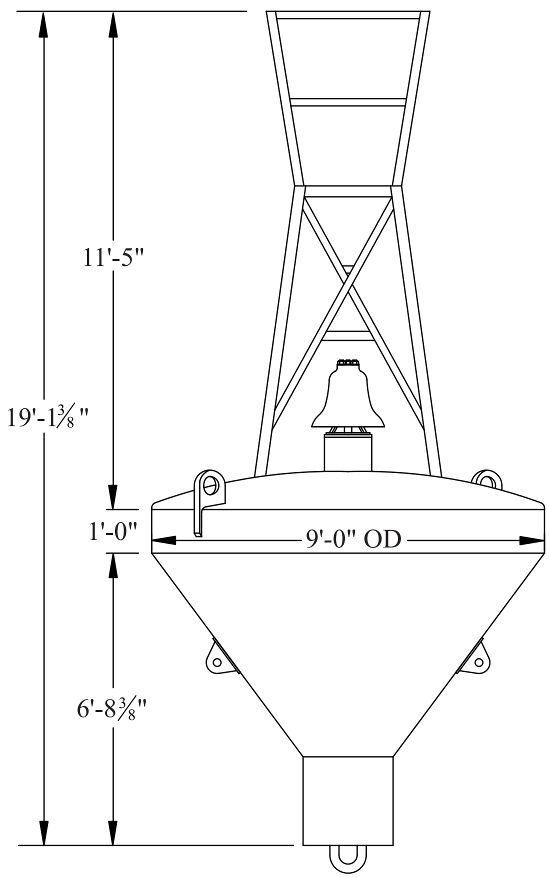
Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1-1/2"	183'
1-1/4"	261'

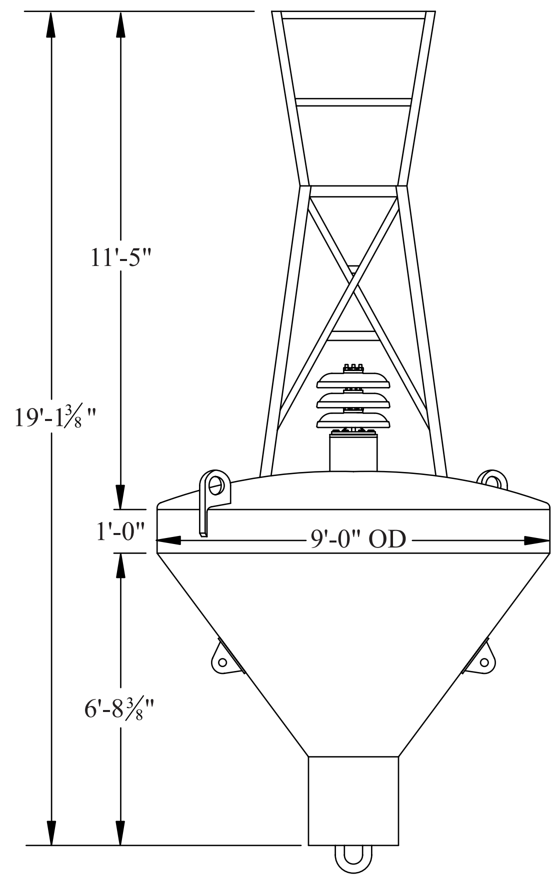
Reference Documents. (use latest rev.)
G-SEC Drawing No. 121137
G-SEC Specification No. 464

Data Sheet 2.K.3. 9X20BR/GR Buoy.

2.K.3. b. Non-Standard Buoys.



1952 TYPE
9X20BR
WEIGHT: 6,875 LBS
DRAWING: BU-52-19

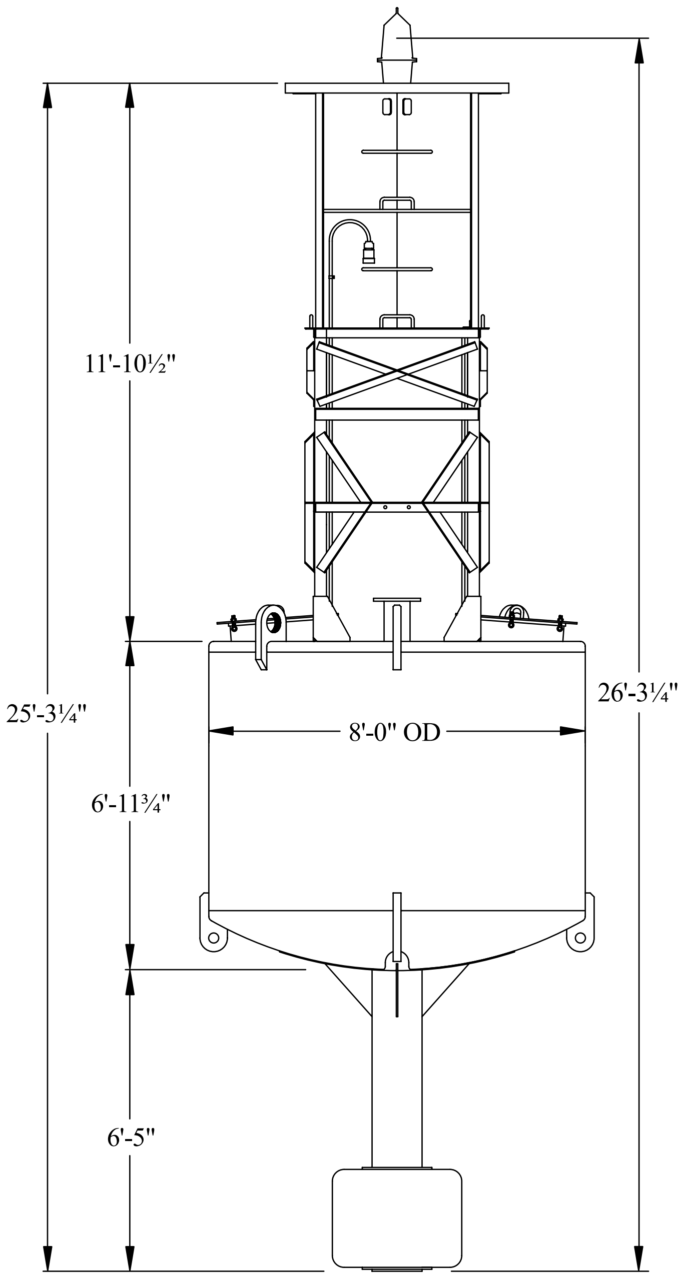


1952 TYPE
9X20GR
WEIGHT: 6,800 LBS
DRAWING: BU-52-19

Data Sheet 2.K.3. (cont'd).

2.K. 4. 8X26LR. The 8X26LR is designed and constructed for exposed locations. It is designed for use as a lighted buoy and can be fitted with a bell, gong, or horn.

a. Standard Buoy Arrangements. 1989 (1962) Type 8X26LR, 8X26LBR, 8X26LGR, 8X26LHR.



Physical Characteristics. (no mooring)

Buoy Weight	11,800 lbs.
Buoy Draft	10 ft. 4 in.
Focal Height of Light	15 ft. 11 in.
Freeboard	3 ft. 1 in.
Minimum Freeboard	1 ft. 3 in.
Pounds-Per-Inch Immersion	264

Related Equipment.

Bell	225 lbs.
Gong	3 ea. 20 in.
Horn	SA-850
Mooring Bridle	1-1/4 in x 15 ft.
Mooring Chain	1 -1/4 in
Sinker (concrete)	8,500 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	3.2 nm
Radar Range	3.7 nm
Mooring Depth (min.)	25 ft.

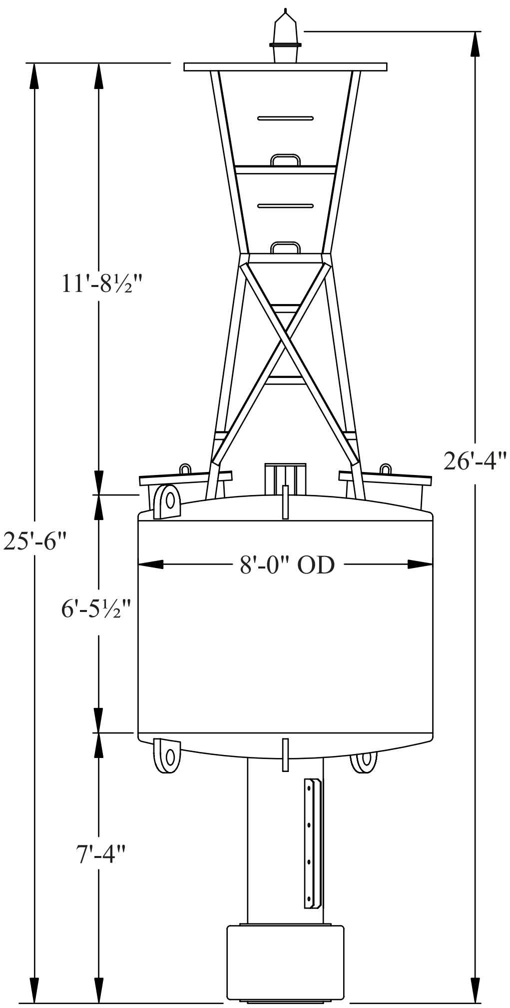
Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1-1/2"	175'
1-1/4"	250'

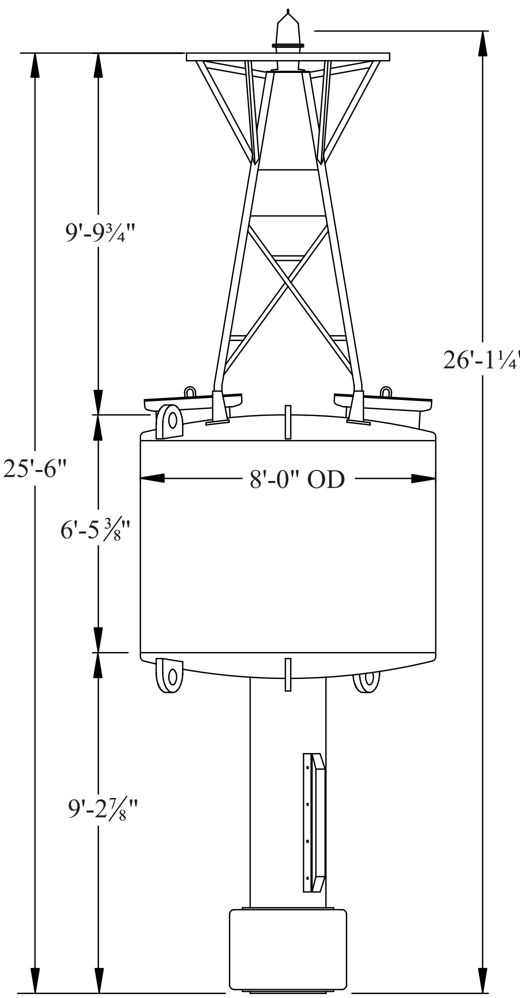
Reference Documents. (use latest rev.)
G-SEC Drawing No. 121130 (107320)
G-SEC Specification No. 464

Data Sheet 2.K.4. 8X26LR Buoy.

2.K.4. b. Non-Standard Buoys.



1952 TYPE
8X26LR
WEIGHT: 11,050 LBS
DRAWING: BU-52-11
DRAWING: BU-50-03 (L)
DRAWING: BU-50-04 (LB)
DRAWING: BU-50-05 (LG)

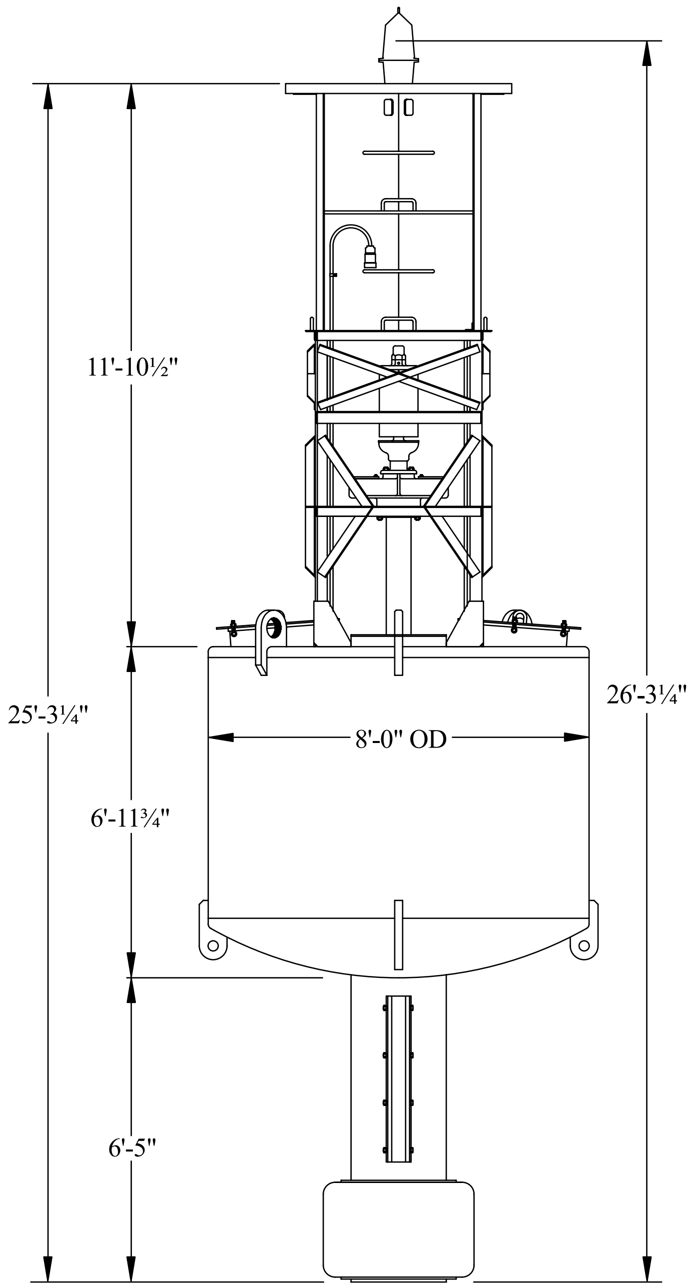


1942 TYPE
8X26L
WEIGHT: 12,000 LBS
DRAWING: BU-42-45
DRAWING: BU-41-151 (LB)
DRAWING: BU-43-30 (LG)

Data Sheet 2.K.4. (cont'd).

2.K. 5. 8X26LWR. The 8X26LWR is designed and constructed for exposed locations. It is designed with an open counterweight tube for use as a lighted whistle buoy.

a. Standard Buoy Arrangements. 1989 (1962) Type 8X26LWR.



Physical Characteristics. (no mooring)

Buoy Weight	12,100 lbs.
Buoy Draft	10 ft. 5 in.
Focal Height of Light	15 ft. 10 in.
Freeboard	3 ft. 0 in.
Minimum Freeboard	1 ft. 3 in.
Pounds-Per-Inch Immersion	250

Related Equipment.

Whistle	4-Ball
Mooring Bridle	1-1/4 in. x 15 ft.
Mooring Chain	1-1/4 in.
Sinker (concrete)	8,500 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	3.2 nm
Radar Range	3.7 nm
Mooring Depth (min.)	25 ft.

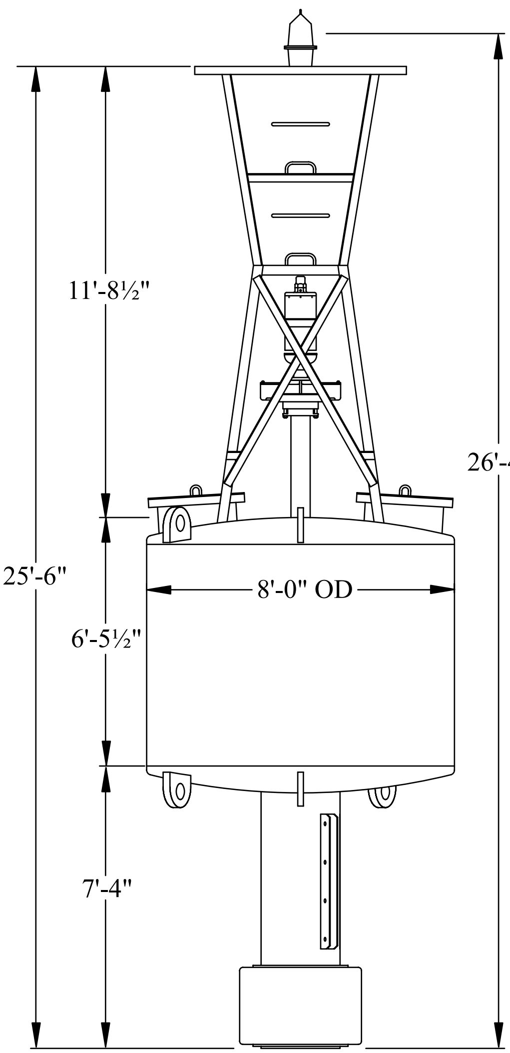
Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1-1/2"	166'
1-1/4"	236'

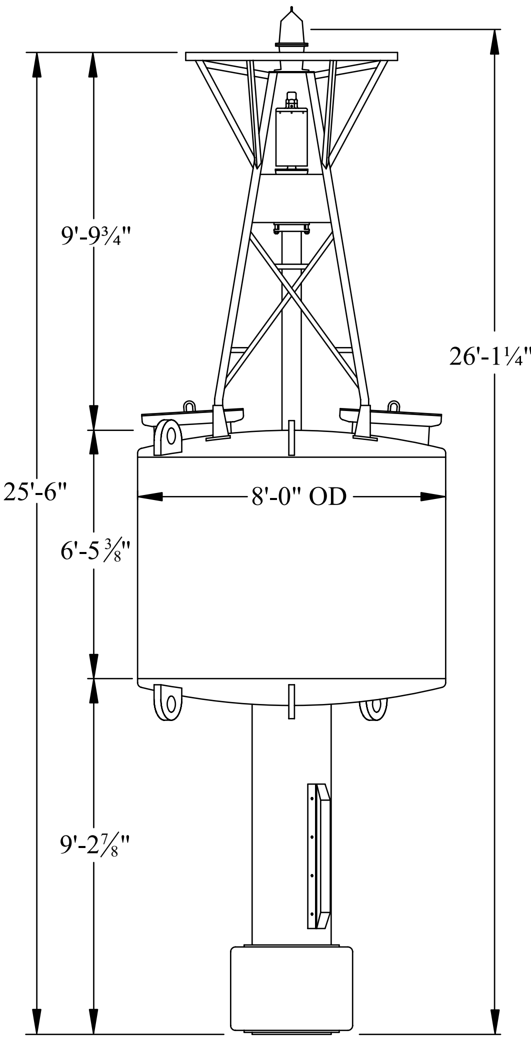
Reference Documents. (use latest rev.)
G-SEC Drawing No. 121131(107320)
G-SEC Specification No. 464

Data Sheet 2.K.5. 8X26LWR Buoy.

2.K.5. b. <u>Non-Standard Buoys</u>.



1952 TYPE
8X26LWR
WEIGHT: 11,550 LBS
DRAWING: BU-52-11
DRAWING: BU-50-06 (LW)

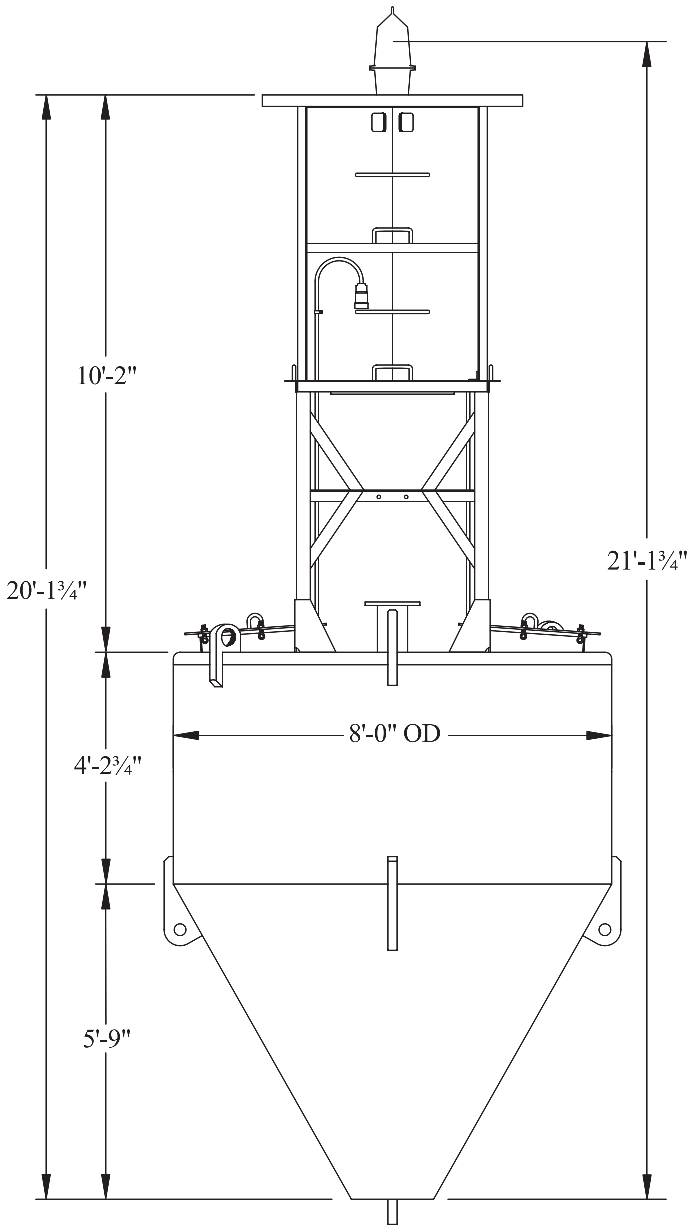


1942 TYPE
8X26LW
WEIGHT: 12,520 LBS
DRAWING: BU-43-27

Data Sheet 2.K.5. (cont'd).

2.K. 6. 8X21LR. The 8X21LR is designed and constructed for exposed locations with shallow water and rough sea conditions. It is designed for use as a lighted buoy and can be fitted with a bell, gong, or horn.

a. Standard Buoy Arrangements. 1991 Type 8X21LR.



Physical Characteristics. (no mooring)

Buoy Weight	13,900 lbs.
Buoy Draft	7 ft. 9 in.
Focal Height of Light	13 ft. 4 in.
Freeboard	2 ft. 3 in.
Minimum Freeboard	11 in.
Pounds-Per-Inch Immersion	264

Related Equipment.

Bell	225 lbs.
Gong	3 ea. 20 in.
Horn	SA-850
Mooring Bridle	1 1/4 in. x 15 ft.
Mooring Chain	1-1/4 in.
Sinker (concrete)	8,500 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	3.0 nm
Radar Range	3.7 nm
Mooring Depth (min.)	18 ft.

Maximum Mooring Depth.

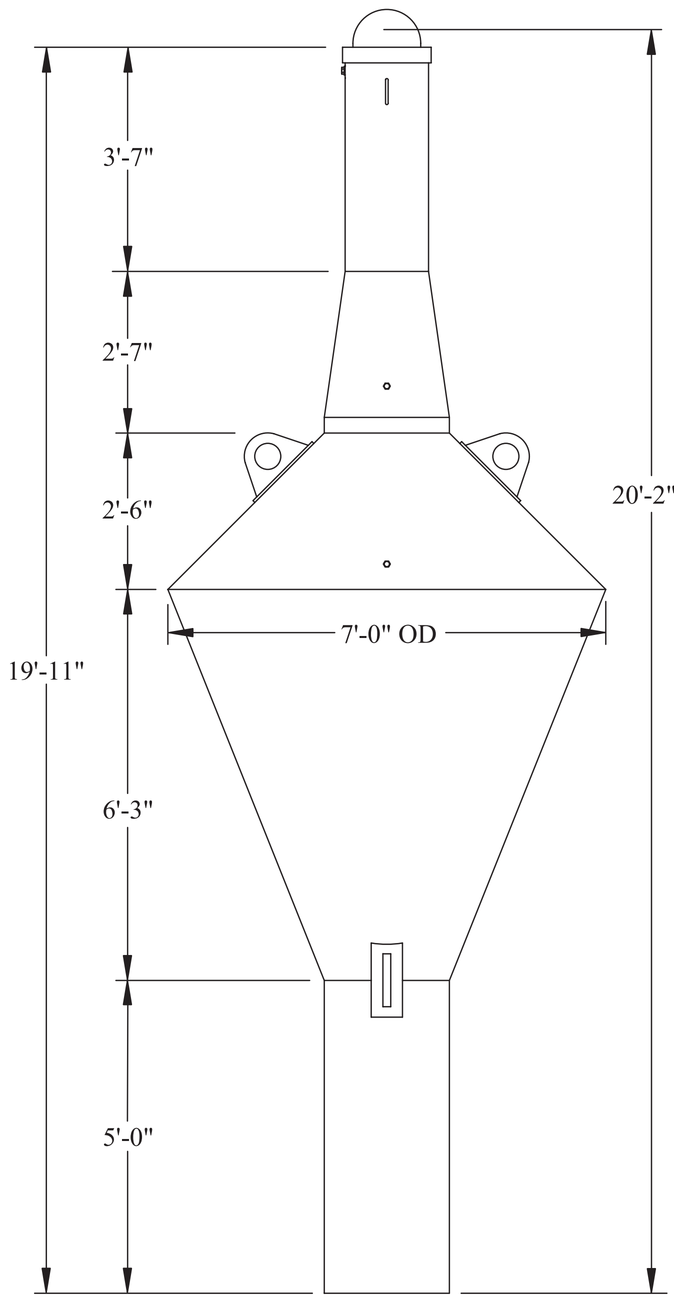
Chain Size	Max Mooring Depth
1-1/2"	128'
1-1/4"	182'
1-1/8"	224'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121145
G-SEC Specification No. 464

Data Sheet 2.K.6. 8X21LR Buoy.

2.K. 7. 7X20LI. The 7X20LI is designed and constructed for use as a seasonal aid in semi-exposed locations subject to ice conditions. It is designed with special lighting and battery equipment to survive entrapment under the ice. Note that the buoy has no radar reflector and has a very small visual profile.

a. Standard Buoy Arrangements. 1962 Type 7X20LI.



Physical Characteristics. (no mooring)

Buoy Weight	6,500 lbs.
Buoy Draft	10 ft. 7. in.
Focal Height of Light	9 ft. 10 in.
Freeboard	3 ft. 1 in.
Minimum Freeboard	2 ft. 6 in.
Pounds-Per-Inch Immersion	170+

Related Equipment.

Optic Protection	Polycarbonate Dome
Mooring Bridle	1 1/4 in. x 15 ft.
Mooring Riser	1/2 in.
Mooring Chain	(From permanent aid)
Sinker	(From permanent aid)

Operational Characteristics. (nominal)

Daymark Visual Range	1.4 nm
Radar Range	0.5 nm
Mooring Depth (min.)	25 ft.

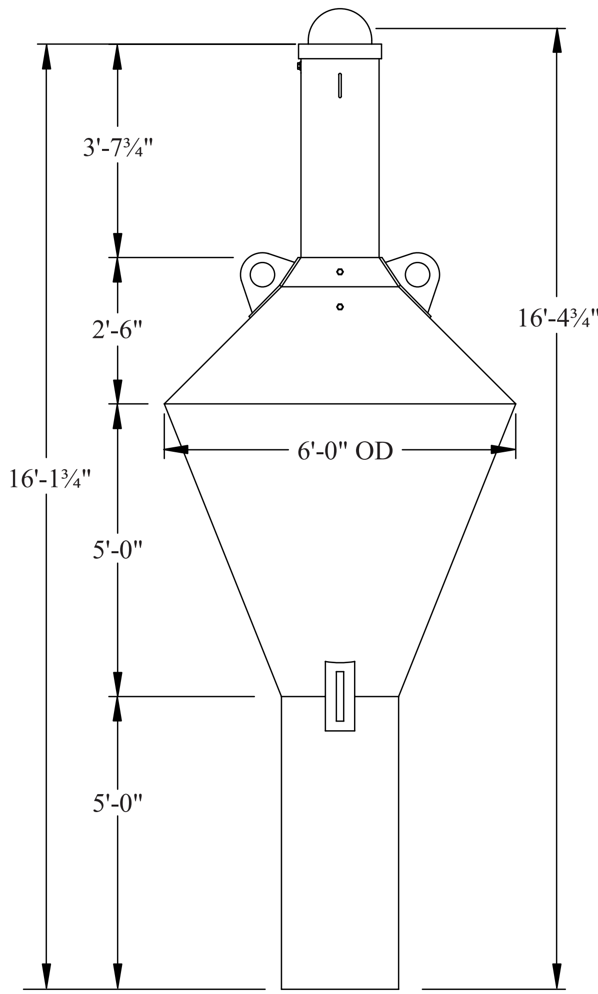
Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1-1/2"	33'
1-1/4"	47'
1-1/8"	60'
1"	75'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 120976
G-SEC Specification No. 464

Data Sheet 2.K.7. 7X20LI Buoy.

2.K.7. b. Non-Standard Buoys.

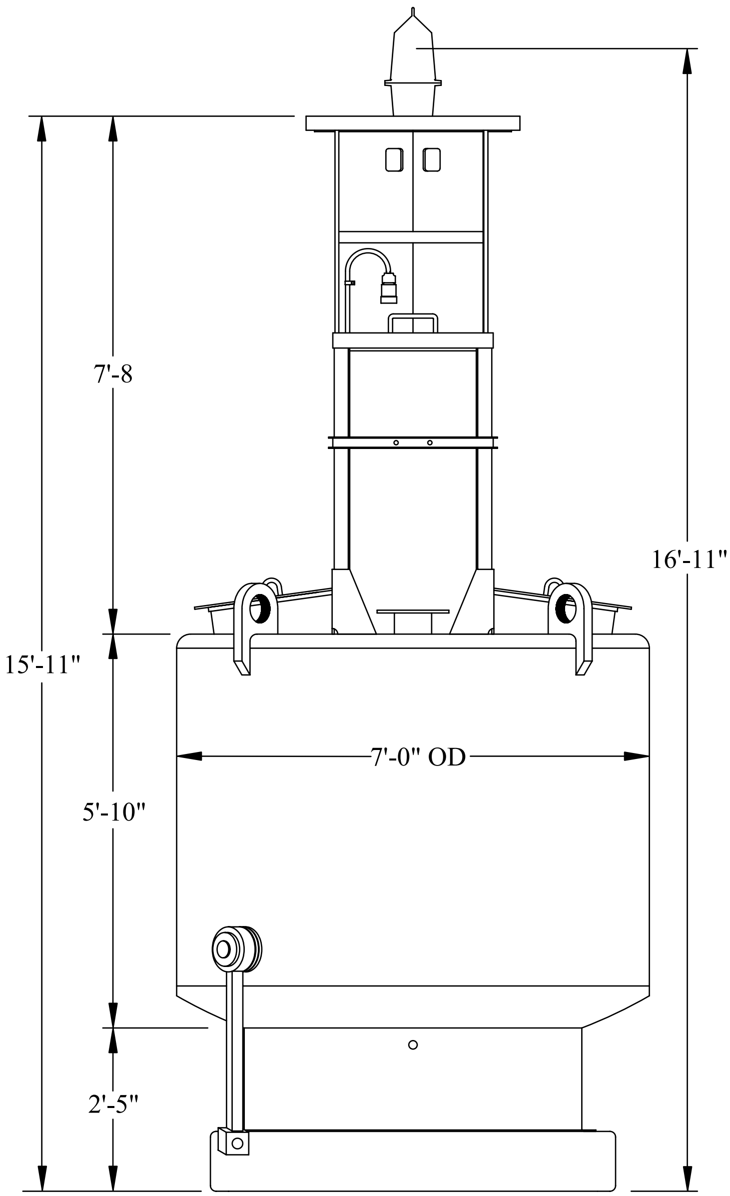


1980 TYPE
6X16LI
DRAWING: 120980

Data Sheet 2.K.7. (cont'd).

2.K. 8. 7X17LR. The 7X17LR is designed and constructed for semi-exposed locations. It is designed for use as a shallow water lighted buoy and can be fitted with a bell or horn.

a. Standard Buoy Arrangements. 1989 (1962) Type 7X17LR, 7X17LBR, 7X17LHR.



Physical Characteristics. (no mooring)

Buoy Weight	7,800 lbs.
Buoy Draft	5 ft. 6 in.
Focal Height of Light	11 ft. 5 in.
Freeboard	3 ft.
Minimum Freeboard	14 in.
Pounds-Per-Inch Immersion	205

Related Equipment.

Bell	85 lbs.
Horn	SA-850
Mooring Bridle	1-1/4 in. x 15 ft.
Mooring Chain	1-1/4 in.
Sinker (concrete)	8,500 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	2.3 nm
Radar Range	2.7 nm
Mooring Depth (min.)	17 ft.

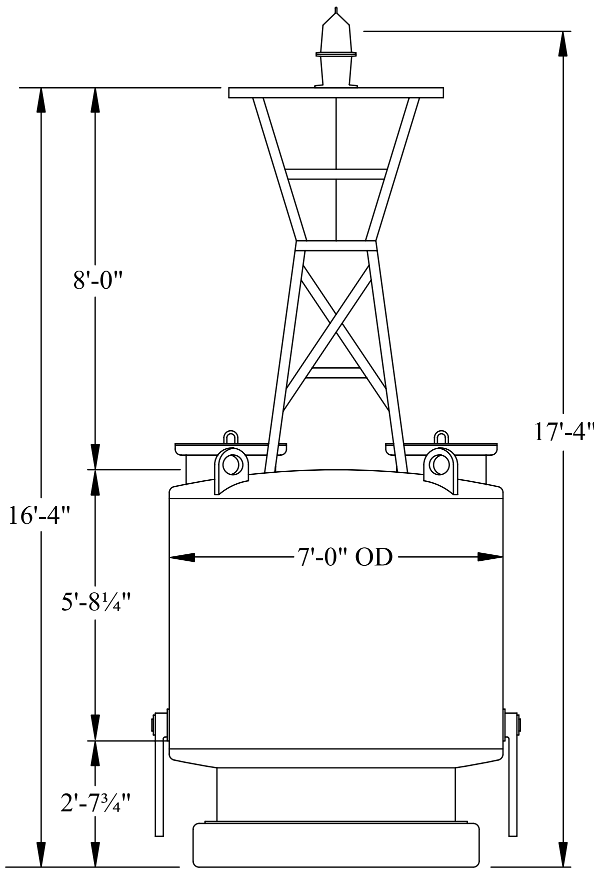
Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1-1/2"	133'
1-1/4"	189'
1-1/8"	233'
1"	291'

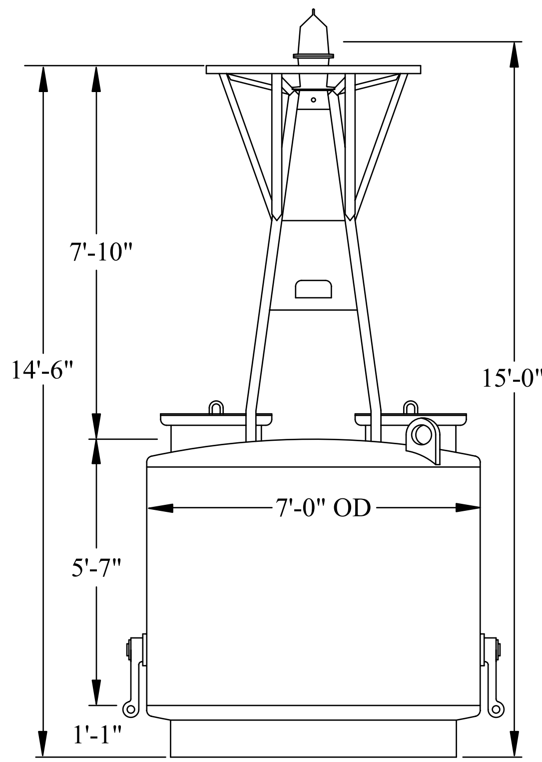
Reference Documents. (use latest rev.)
G-SEC Drawing No. 121129(107323)
G-SEC Specification No. 464

Data Sheet 2.K.8. 7X17LR Buoy.

2.K.8. b. Non-Standard Buoys.



1952 TYPE
7X17LR
WEIGHT: 8,075 LBS
DRAWING: BU-52-16

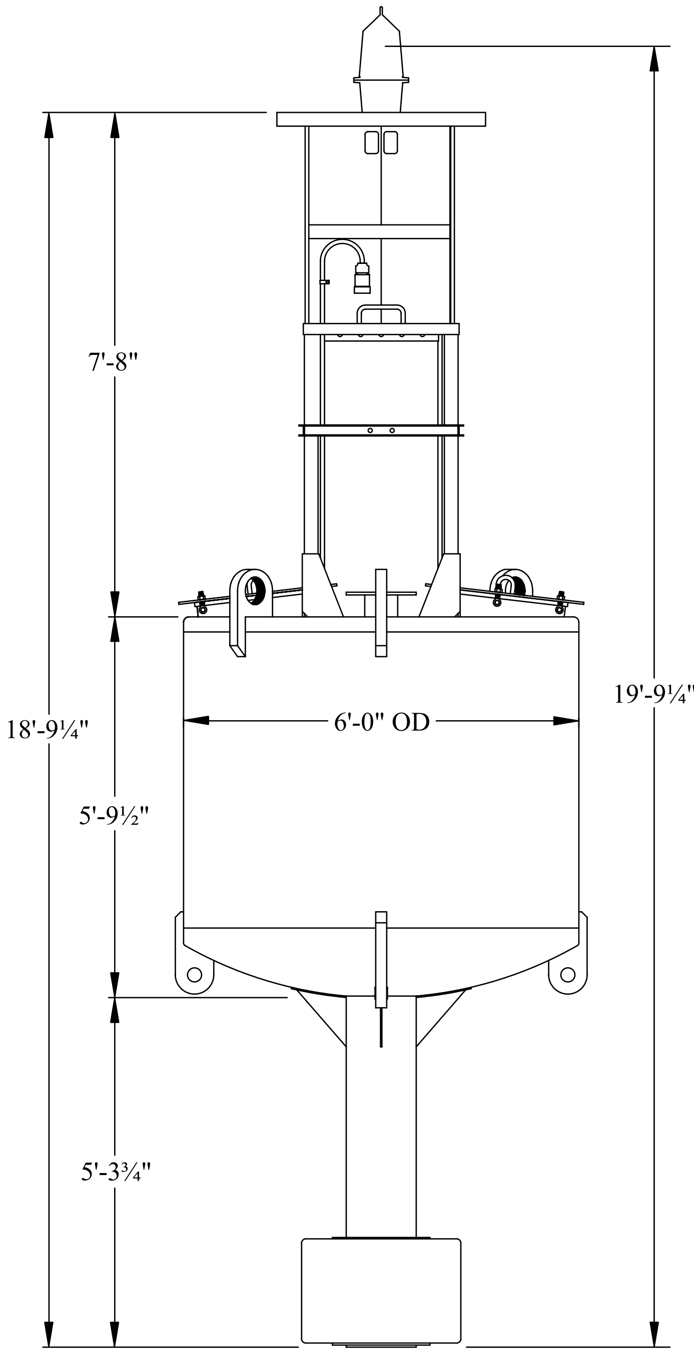


1942 TYPE
7X15L
WEIGHT: 5,760 LBS
DRAWING: BU-44-10

Data Sheet 2.K.8. (cont'd).

2.K. 9. 6X20LR. The 6X20LR is designed and constructed for semi-exposed locations. It is designed for use as a lighted buoy and can be fitted with a bell or horn.

a. Standard Buoy Arrangements. 1992 Type 6X20LR, 6X20LBR, 6X20LHR.



Physical Characteristics. (no mooring)

Buoy Weight	6,500 lbs.
Buoy Draft	9 ft. 0 in.
Focal Height of Light	10 ft. 9 in.
Freeboard	2 ft. 1 in.
Minimum Freeboard	10 in.
Pounds-Per-Inch Immersion	150

Related Equipment.

Bell	85 lbs.
Horn	SA-850
Mooring Bridle	1 in. x 12 ft.
Mooring Chain	1 1/4 in.
Sinker (concrete)	5,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	2.1 nm
Radar Range	2.4 nm
Mooring Depth (min.)	20 ft.

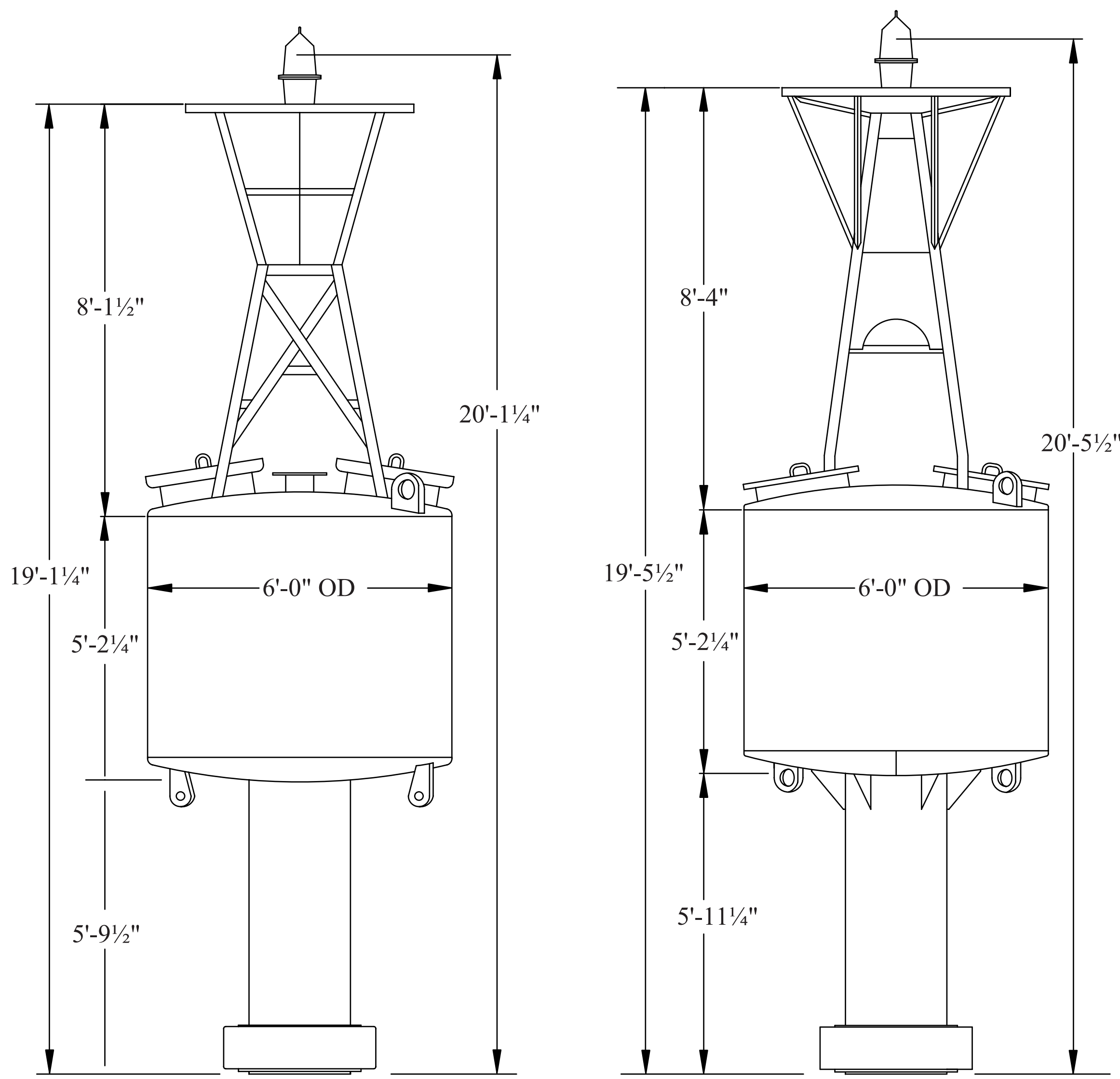
Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1-1/2"	69'
1-1/4"	97'
1-1/8"	120'
1"	149'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121152(107324)
G-SEC Specification No. 464

Data Sheet 2.K.9. 6X20LR Buoy.

2.K.9. b. Non-Standard Buoys.



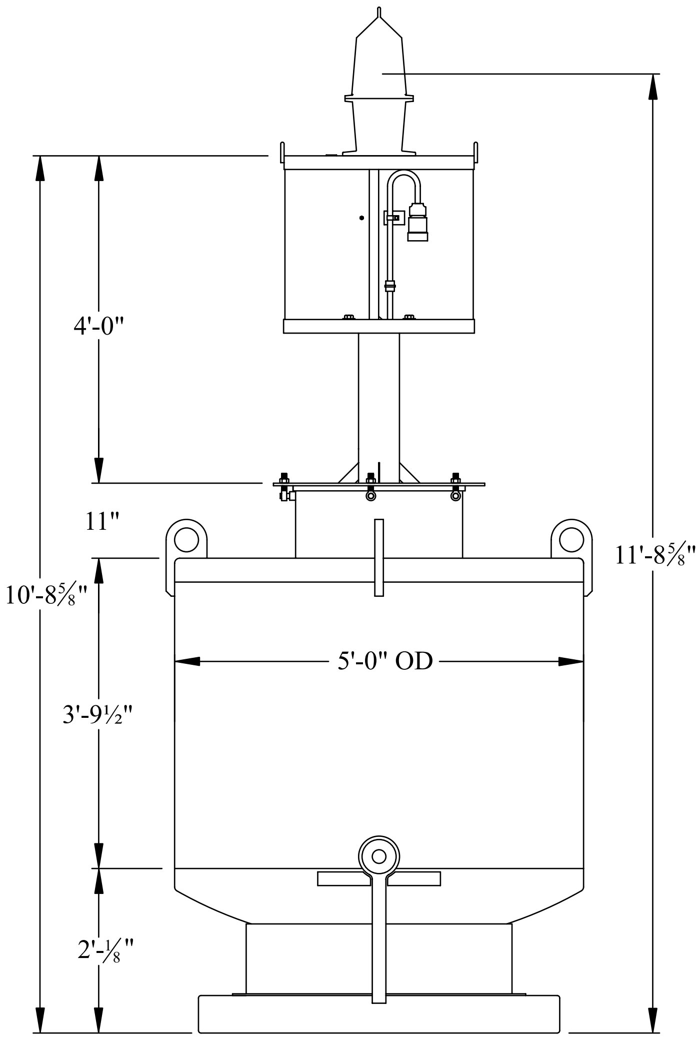
1952 TYPE
6X20LR
WEIGHT: 5,050 LBS
DRAWING: BU-52-13

1942 TYPE
6X20L
WEIGHT: 4,900 LBS
DRAWING: BU-42-02
DRAWING: BU-44-17
DRAWING: BU-44-31
DRAWING: BU-46-17

Data Sheet 2.K.9. (cont'd).

2.K. 10. 5X11LR. The 5X11LR is designed and constructed for protected locations. It is designed for use as a shallow water lighted buoy. The radar relector has lateral significance. Can and nun tops are available.

a. Standard Buoy Arrangements. 1992 Type 5X11LCR, 5X11LNR.



Physical Characteristics. (no mooring)

Buoy Weight	3,000 lbs.
Buoy Draft	3 ft. 9 in.
Focal Height of Light	8 ft.
Freeboard	2 ft. 1 in.
Minimum Freeboard	10 in.
Pounds-Per-Inch Immersion	105

Related Equipment.

Mooring Bridle	1 in. x 12 ft.
Mooring Chain	1 in.
Sinker (concrete)	4,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1.4 nm
Radar Range	1.7 nm
Mooring Depth (min.)	13 ft.

Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1-1/4"	69'
1-1/8"	84'
1"	105'

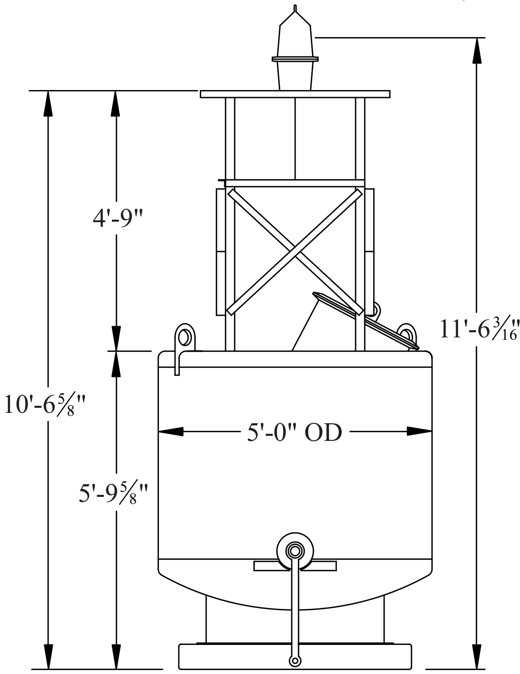
Reference Documents. (use latest rev.)

G-SEC Drawings:

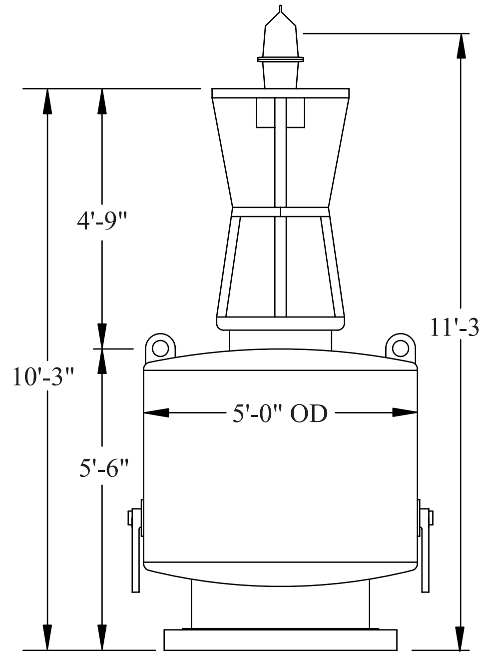
Buoy (5X11LR)	No. 121158(107379)
Nun Radar Reflector	No. 120316
Can Radar Reflector	No. 121024
G-SEC Specification	No. 464

Data Sheet 2.K.10. 5X11LR Buoy.

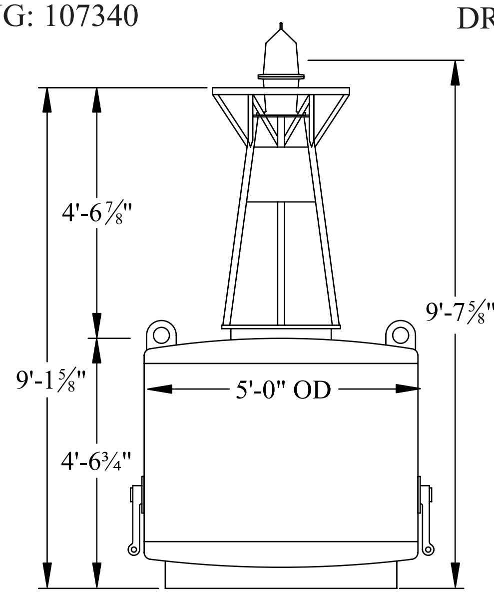
2.K.10. b. <u>Non-Standard Buoys</u>.



1962 TYPE
5X11LR
WEIGHT: 3,150 LBS
DRAWING: 107340



1952 TYPE
5X11LR
WEIGHT: 2,950 LBS
DRAWING: BU-52-17

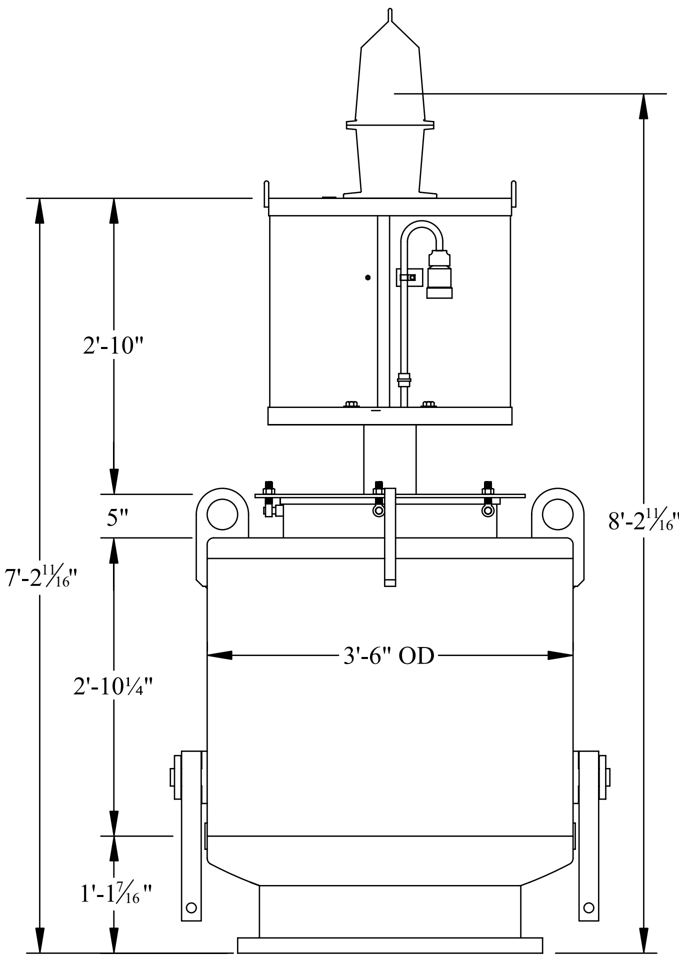


1952 TYPE
5X11L
WEIGHT: 2,770 LBS
DRAWING: BU-44-12

Data Sheet 2.K.10. (cont'd).

2.K. 11. 3.5X8LR. The 3.5X8LR is designed and constructed for use in shallow water and the most protected locations. The radar reflector has lateral significance. Can and nun tops are available. Due to its limited freeboard, the use of solar power is recommended.

a. Standard Buoy Arrangements. 1992 Type 3.5X8LCR, 3.5X8LNR.



Physical Characteristics. (no mooring)

Buoy Weight	1,500 lbs.
Buoy Draft	2 ft. 9 in.
Focal Height of Light	5 ft. 7 in.
Freeboard	1 ft. 4 in.
Minimum Freeboard	6 in.
Pounds-Per-Inch Immersion	50

Related Equipment.

Mooring Bridle	7/8 in. x 10 ft.
Mooring Chain	3/4 in.
Sinker (concrete)	3,000 lb.

Operational Characteristics. (nominal)

Daymark Visual Range	1.4 nm
Radar Range	1.3 nm
Mooring Depth (min.)	11 ft.

Maximum Mooring Depth.

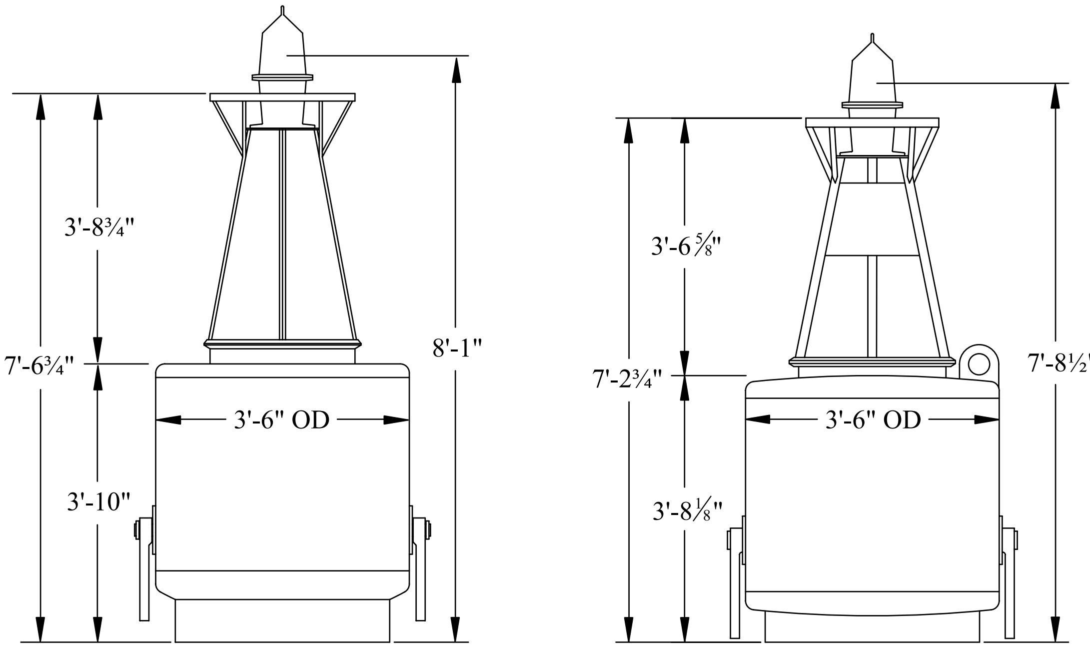
Chain Size	Max Mooring Depth
1"	33'
7/8"	41'
3/4"	55'

Reference Documents. (use latest rev.)

G-SEC Drawing	
Buoy (3.5X8LR):	No. 121157(107377)
Nun Radar Reflector:	No. 120316
Can Radar Reflector:	No. 121024
G-SEC Specification	No. 464

Data Sheet 2.K.11. 3.5X8LR Buoy.

2.K.11. b. Non-Standard Buoys.



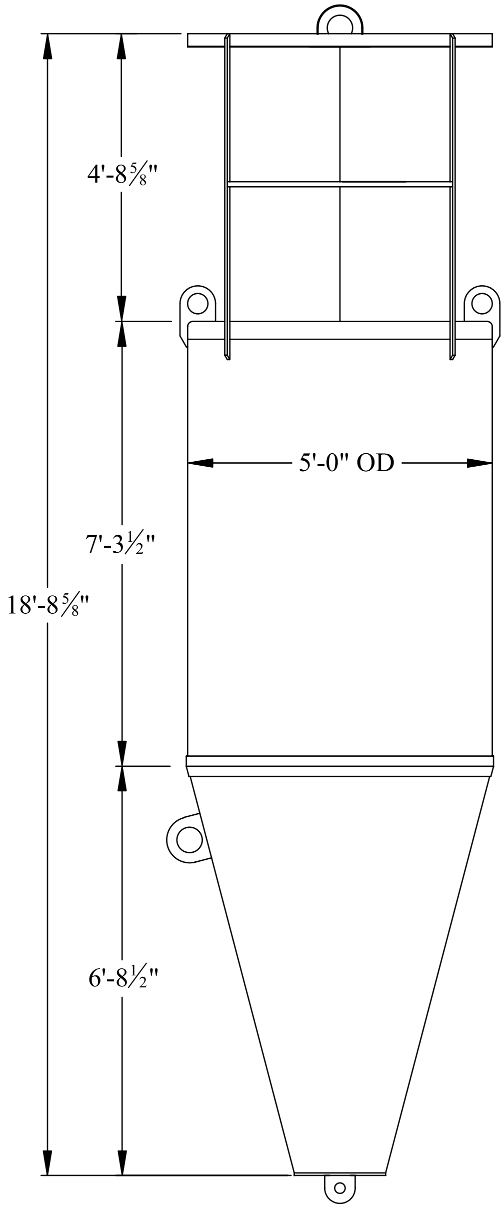
1962 TYPE
3.5X8LR
WEIGHT: 1,025 LBS
DRAWING: 107328

1952 TYPE
3.5X8L
WEIGHT: 1,115 LBS
DRAWING: BU-41-153

Data Sheet 2.K.11. (cont'd).

2.K. 12. 1CR. The 1CR is designed and constructed for the most exposed locations where unlighted lateral buoys are required.

a. Standard Buoy Arrangements. 1988 Type 1CR.



Physical Characteristics. (no mooring)

Buoy Weight	6,100 lbs.
Buoy Draft	8 ft. 7 in.
Freeboard	5 ft. 5 in.
Minimum Freeboard	2 ft. 2 in.
Pounds-Per-Inch Immersion	104

Related Equipment.

Mooring Chain	1-1/4 in.
Sinker (concrete)	8,500 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	3.8 nm
Radar Range	3.5 nm
Mooring Depth (min.)	15 ft.

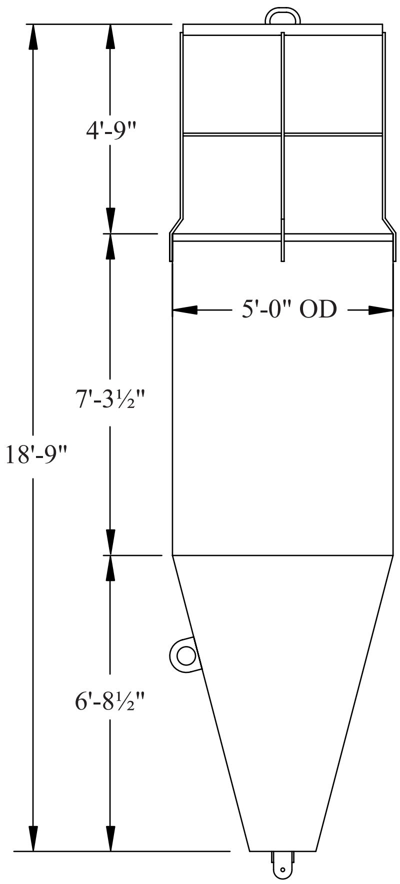
Maximum Mooring Depth.

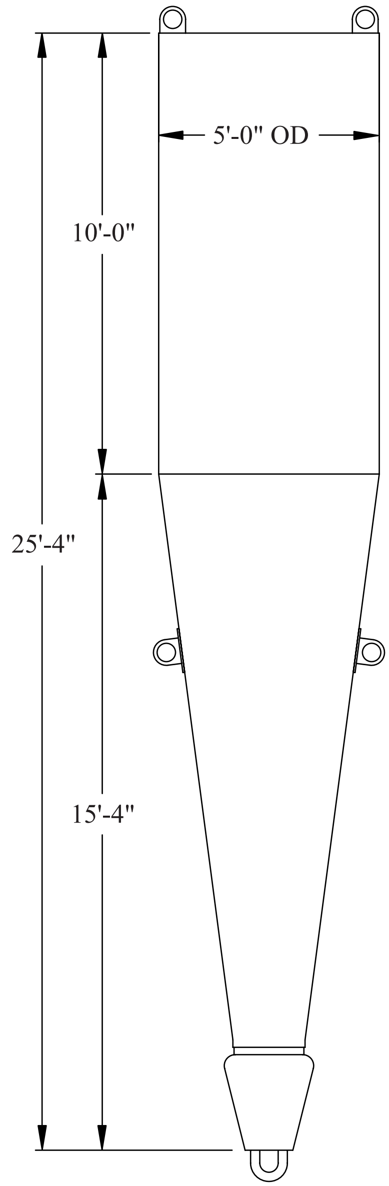
Chain Size	Max Mooring Depth
1-1/2"	121'
1-1/4"	174'
1-1/8"	216'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121109
G-SEC Specification No. 464

Data Sheet 2.K.12. 1CR Buoy.

2.K.12. b. Non-Standard Buoys.





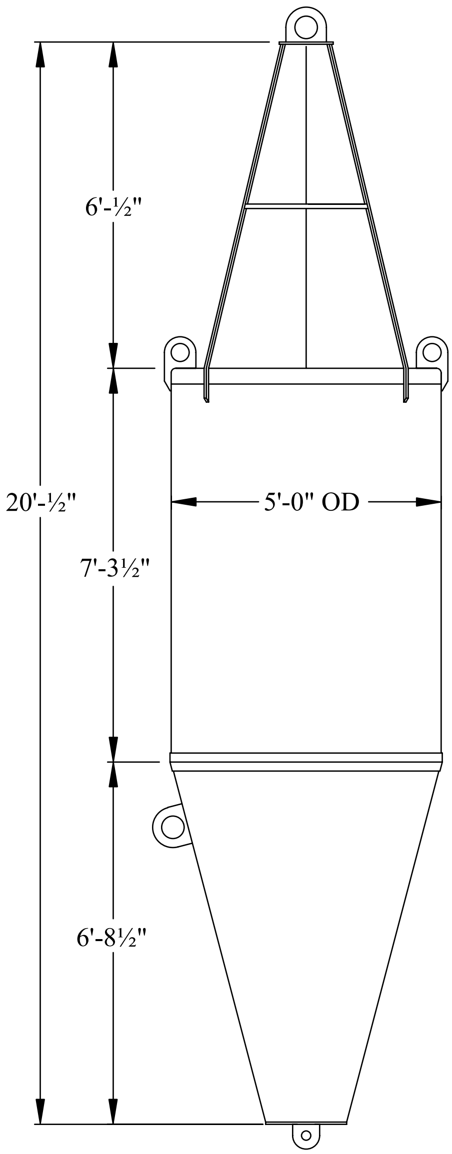
1952 TYPE
1CR
WEIGHT: 5,255 LBS
DRAWING: BU-58-08
DRAWING: BU-52-06

1942 TYPE
1CT
WEIGHT: 6,925 LBS
DRAWING: BU-43-32

Data Sheet 2.K.12. (cont'd).

2.K. 13. 1NR. The 1NR is designed and constructed for the most exposed locations where unlighted lateral buoys are required.

a. Standard Buoy Arrangement. 1988 Type 1NR.



Physical Characteristics. (no mooring)

Buoy Weight	6,000 lbs.
Buoy Draft	8 ft. 4 in.
Freeboard	5 ft. 8 in.
Minimum Freeboard	2 ft. 3 in.
Pounds-Per-Inch Immersion	104

Related Equipment.

Mooring Chain	1-1/4 in.
Sinker (concrete)	8,500 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	3.5 nm
Radar Range	3.5 nm
Mooring Depth (min.)	15 ft.

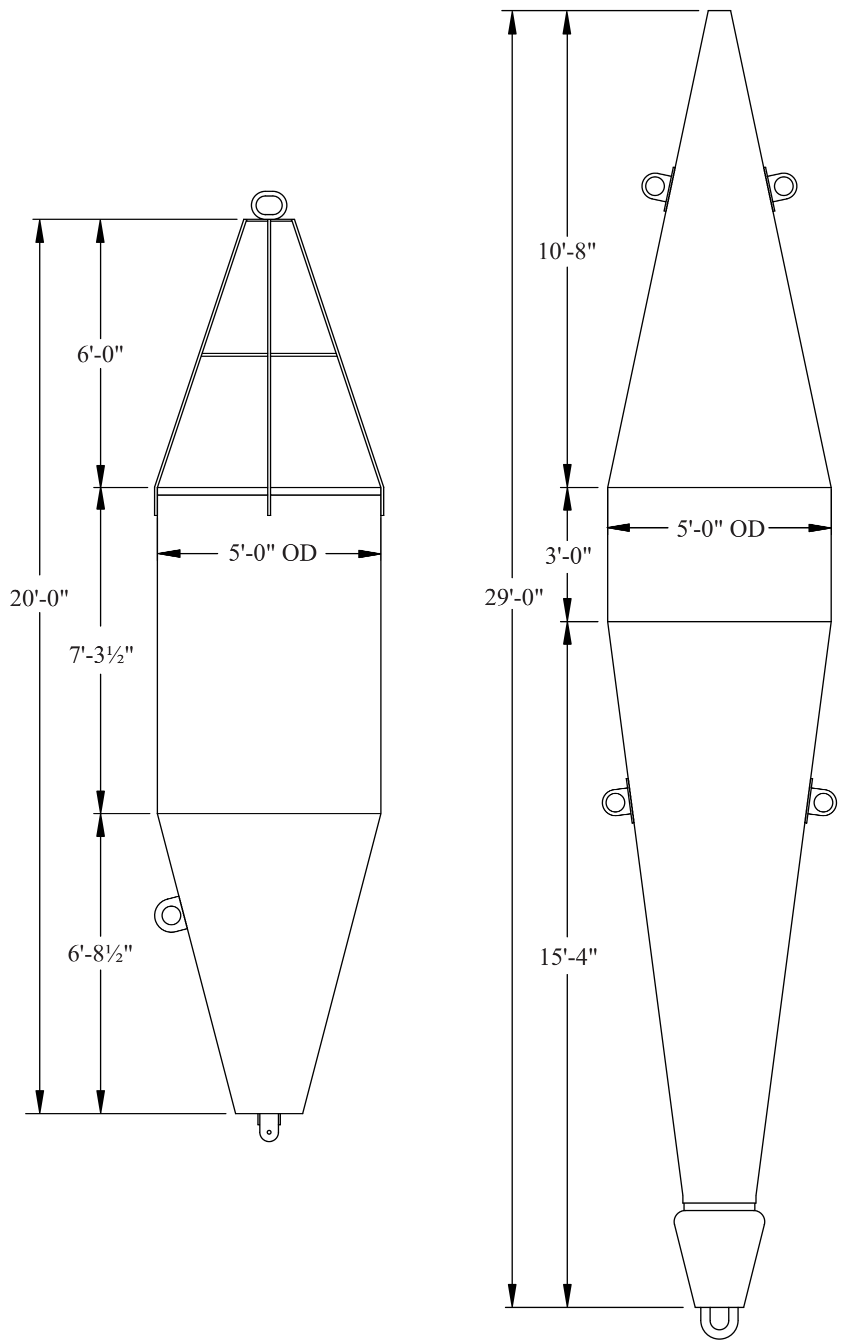
Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1-1/2"	126'
1-1/4"	182'
1-1/8"	226'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121108
G-SEC Specification No. 464

Data Sheet 2.K.13. 1NR Buoy.

2.K.13. b. <u>Non-Standard Buoys</u>.

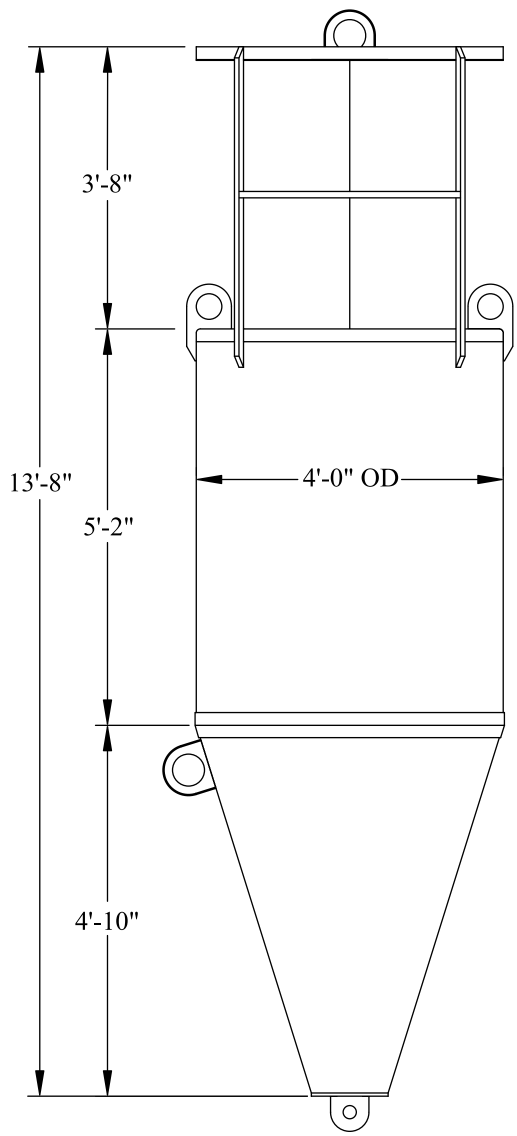


1952 TYPE	1942 TYPE
1NR	1NT
WEIGHT: 4,980 LBS	WEIGHT: 6,435 LBS
DRAWING: BU-58-05	DRAWING: BU-43-32
DRAWING: BU-52-06	

Data Sheet 2.K.13. (cont'd).

2.K. 14. 2CR. The 2CR is designed and constructed for exposed locations where unlighted lateral buoys are required.

a. Standard Buoy Arrangement. 1988 Type 2CR.



Physical Characteristics. (no mooring)

Buoy Weight	2,800 lbs.
Buoy Draft	6 ft. 3 in.
Freeboard	3 ft. 9 in.
Minimum Freeboard	1 ft. 6 in.
Pounds-Per-Inch Immersion	67

Related Equipment.

Mooring Chain	1 in.
Sinker (concrete)	5,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	2.8 nm
Radar Range	2.5 nm
Mooring Depth (min.)	15 ft.

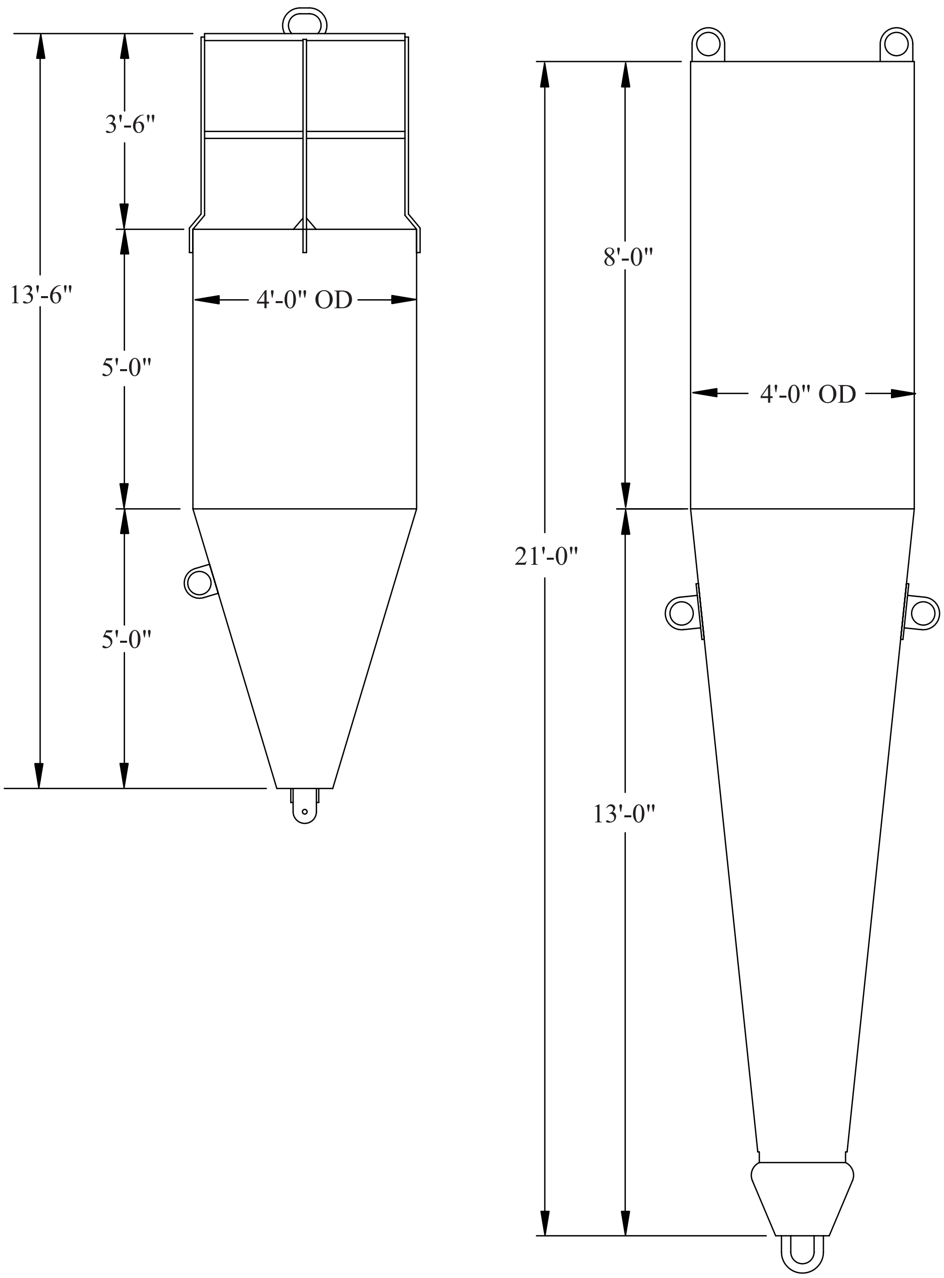
Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1-1/4"	78'
1-1/8"	97 '
1"	121'

Reference Document. (use latest rev.)
G-SEC Drawing No. 121111
G-SEC Specification No. 464

Data Sheet 2.K.14. 2CR Buoy.

2.K.14. b. Non-Standard Buoys.



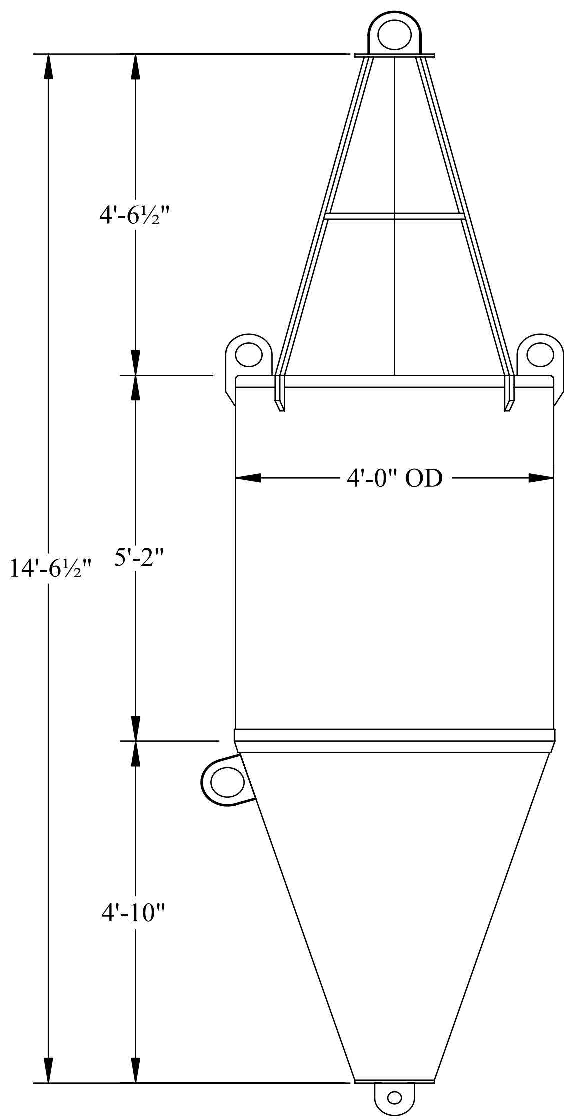
1952 TYPE
2CR
WEIGHT: 2,590 LBS
DRAWING: BU-58-08
DRAWING: BU-52-06

1942 TYPE
2CT
WEIGHT: 4,580 LBS
DRAWING: BU-43-32

Data Sheet 2.K.14. (cont'd).

2.K. 15. 2NR. The 2NR is designed and constructed for exposed locations where unlighted lateral buoys are required.

a. Standard Buoy Arrangement. 1988 Type 2NR.



Physical Characteristics. (no mooring)

Buoy Weight	2,600 lbs.
Buoy Draft	6 ft. 1 in.
Freeboard	3 ft. 11 in.
Minimum Freeboard	1 ft. 7 in.
Pounds-Per-Inch Immersion	67

Related Equipment.

Mooring Chain	1 in.
Sinker (concrete)	5,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	2.6 nm
Radar Range	3.0 nm
Mooring Depth (min.)	15 ft.

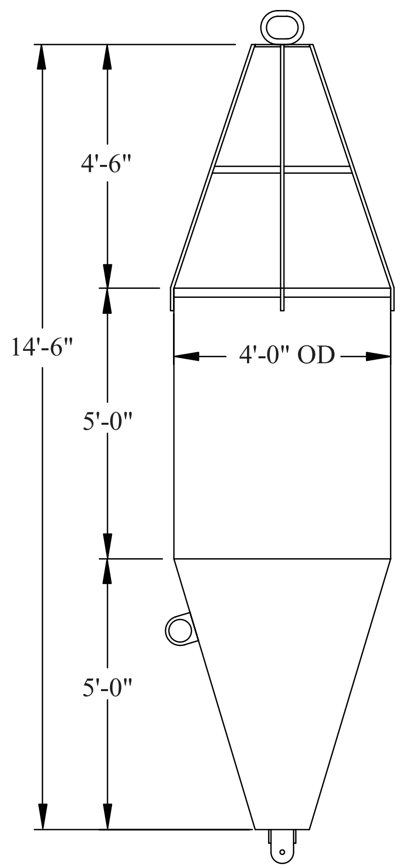
Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1-1/4	81'
1-1/8"	101'
1"	127'

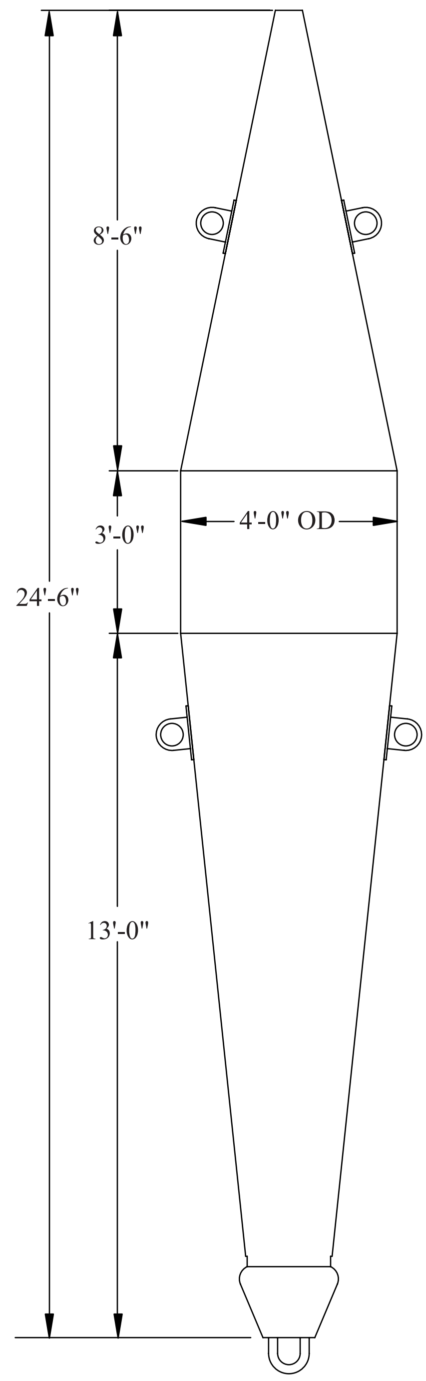
Reference Documents. (use latest rev.)
G-SEC Drawing No. 121110
G-SEC Specification No. 464

Data Sheet 2.K.15. 2NR Buoy.

2.K.15. b. <u>Non-Standard Buoys</u>.



1952 TYPE
2NR
WEIGHT: 2,490 LBS
DRAWING: BU-58-08
DRAWING: BU-52-06

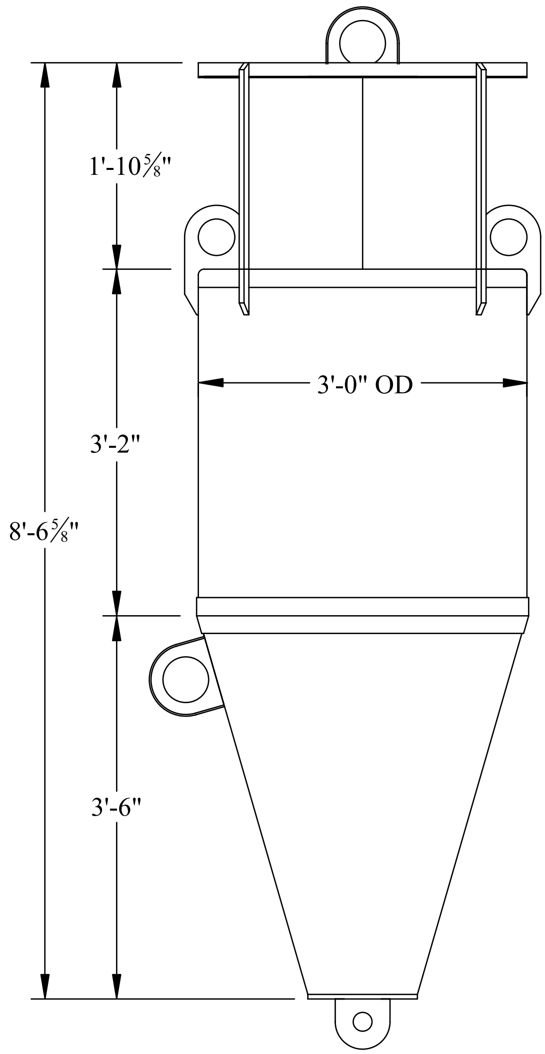


1942 TYPE
2NT
WEIGHT: 4,520 LBS
DRAWING: BU-43-32

Data Sheet 2.K.15. (cont'd).

2.K. 16. 3CR. The 3CR is designed and constructed for semi-exposed locations where unlighted lateral buoys are required.

a. Standard Buoy Arrangement. 1988 Type 3CR.



Physical Characteristics. (no mooring)

Buoy Weight	1200 lbs.
Buoy Draft	4 ft. 4 in.
Freeboard	2 ft. 4 in.
Minimum Freeboard	11 in.
Pounds-Per-Inch Immersion	38

Related Equipment.

Mooring Chain	3/4 in.
Sinker (concrete)	3,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1.4 nm
Radar Range	1.6 nm
Mooring Depth (min.)	10 ft.

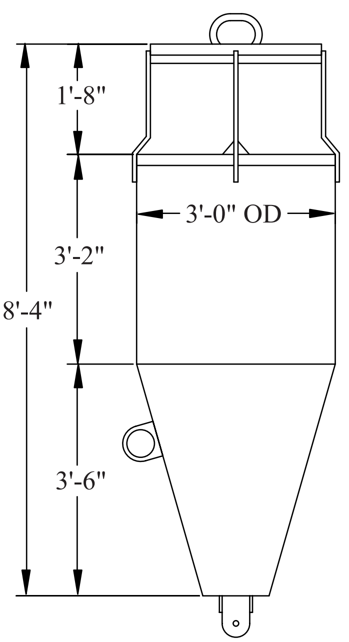
Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1"	43'
7/8"	56'
3/4"	76'

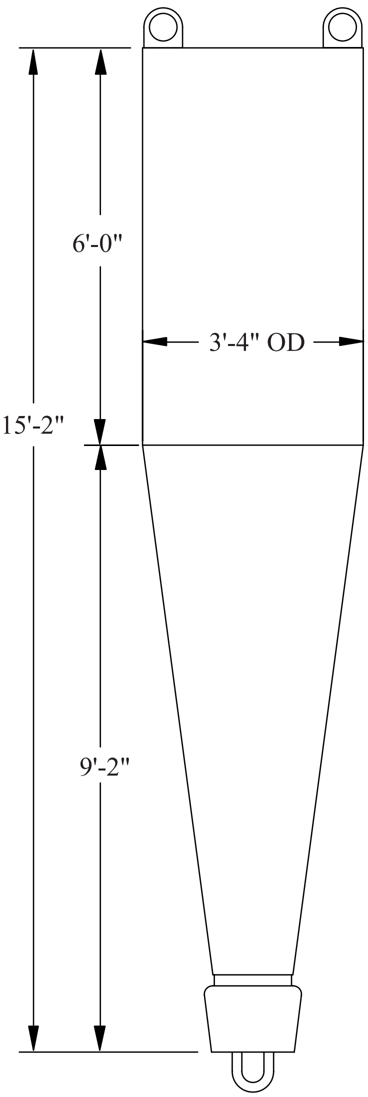
Reference Documents. (use latest rev.)
G-SEC Drawing No. 121113
G-SEC Specification No. 464

Data Sheet 2.K.16. 3CR Buoy.

2.K.16. b. <u>Non-Standard Buoys</u>.



1952 TYPE
3CR
WEIGHT: 890 LBS
DRAWING: BU-58-09
DRAWING: BU-52-06

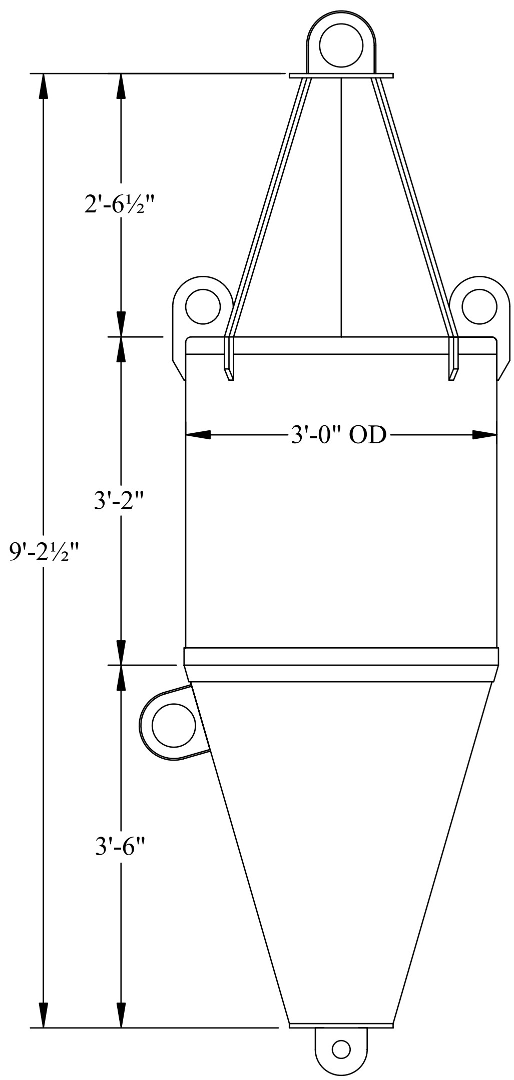


1942 TYPE
3CT
WEIGHT: 2,355 LBS
DRAWING: BU-43-32

Data Sheet 2.K.16. (cont'd).

2.K. 17. 3NR. The 3NR is designed and constructed for semi-exposed locations where unlighted lateral buoys are required.

a. Standard Buoy Arrangement. 1988 Type 3NR.



Physical Characteristics. (no mooring)

Buoy Weight	1175 lbs.
Buoy Draft	4 ft. 4 in.
Freeboard	2 ft. 4 in.
Minimum Freeboard	11 in.
Pounds-Per-Inch Immersion	38

Related Equipment.

Mooring Chain	3/4 in.
Sinker (concrete)	3,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1.4 nm
Radar Range	1.8 nm
Mooring Depth (min.)	10 ft.

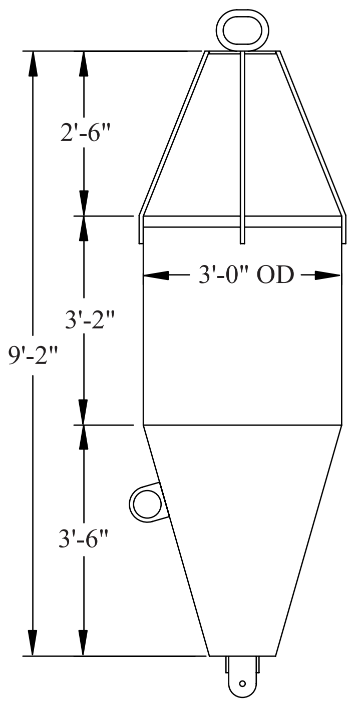
Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1"	43'
7/8"	56'
3/4"	76'

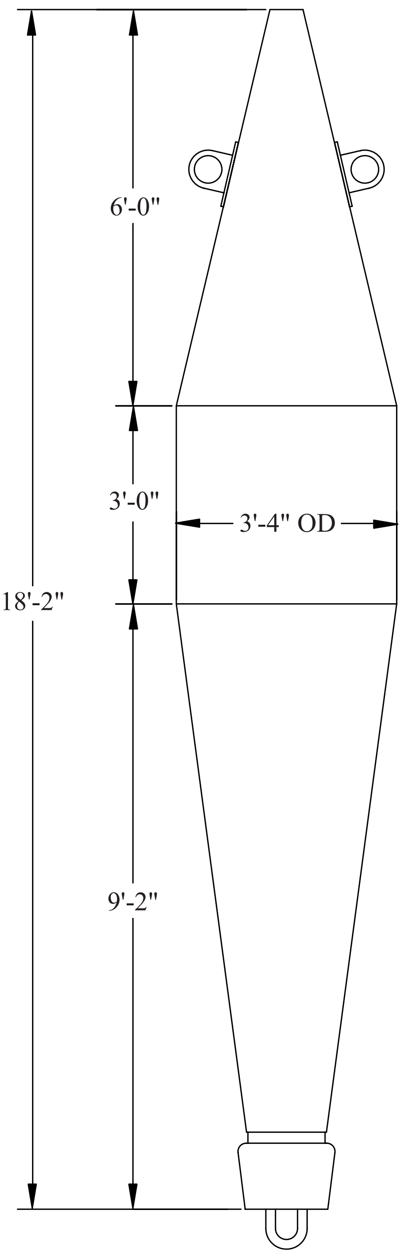
Reference Documents. (use latest rev.)
G-SEC Drawing No. 121112
G-SEC Specification No. 464

Data Sheet 2.K.17. 3NR Buoy.

2.K.17. b. Non-Standard Buoys.



1952 TYPE
3NR
WEIGHT: 880 LBS
DRAWING: BU-58-09

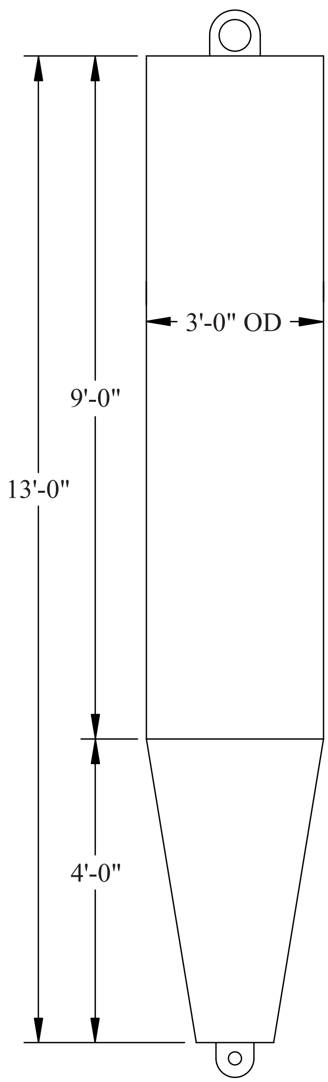


1942 TYPE
3NT
WEIGHT: 2,260 LBS
DRAWING: BU-43-32

Data Sheet 2.K.17. (cont'd).

2.K. 18. 3CI. The 3CI is designed and constructed for locations susceptible to ice where unlighted lateral buoys are required. Note that the buoy does not have a radar reflector.

a. Standard Buoy Arrangement. 1982 Type 3CI.



Physical Characteristics. (no mooring)

Buoy Weight	1,550 lbs.
Buoy Draft	7 ft. 7 in.
Freeboard	5 ft. 5 in.
Minimum Freeboard	3 ft. 9 in.
Pounds-Per-Inch Immersion	22

Related Equipment.

Mooring Chain	3/4 in.
Sinker (concrete)	3,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1.4 nm
Radar Range	0.5 nm
Mooring Depth (min.)	15 ft.

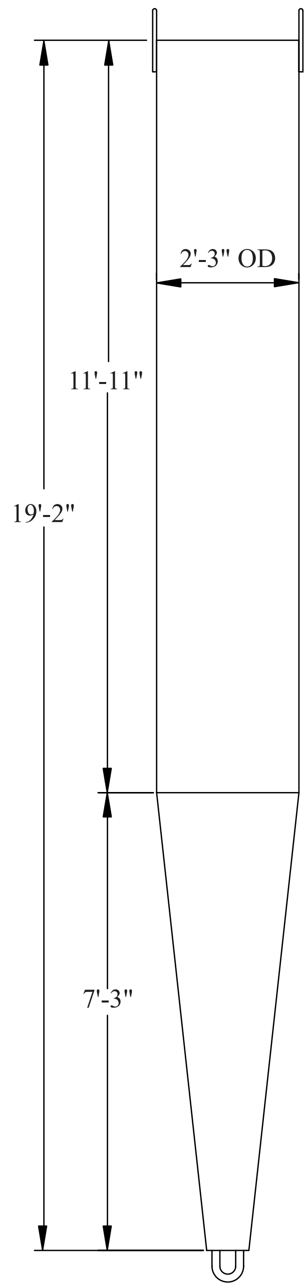
Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1"	30'
7/8"	39'
3/4"	53'

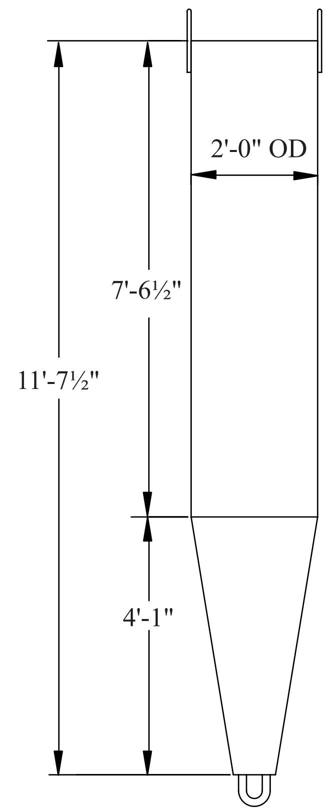
Reference Documents. (use latest rev.)
G-SEC Drawing No. 121028
G-SEC Specification No. 464

Data Sheet 2.K.18. 3CI Buoy.

2.K.18. b. <u>Non-Standard Buoys</u>.



1942 TYPE
1CS
WEIGHT: 2,090 LBS
DRAWING: BU-43-26

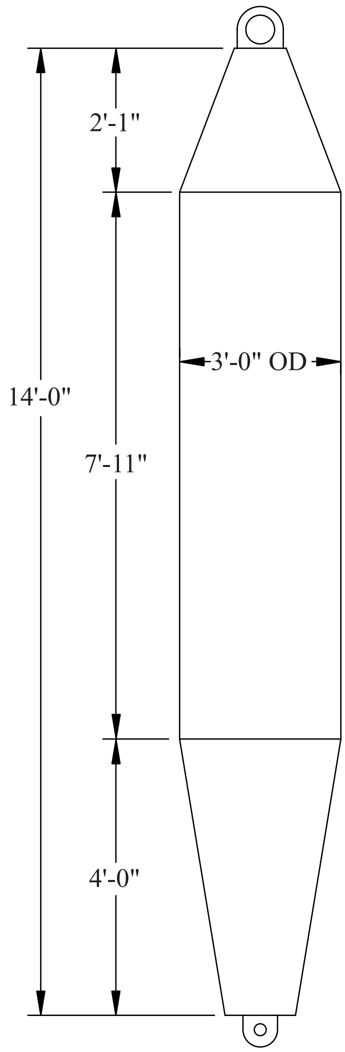


1942 TYPE
2CS
WEIGHT: 1,010 LBS
DRAWING: BU-43-26

Data Sheet 2.K.18. (cont'd).

2.K. 19. 3NI. The 3NI is designed and constructed for locations susceptible to ice where unlighted lateral buoys are required. Note the buoy does not have a radar reflector.

a. Standard Buoy Arrangement. 1982 Type 3NI.



Physical Characteristics. (no mooring)

Buoy Weight	1,550 lbs.
Buoy Draft	7 ft. 7 in.
Freeboard	6 ft. 5 in.
Minimum Freeboard	4 ft. 11 in.
Pounds-Per-Inch Immersion	22

Related Equipment.

Mooring Chain	3/4 in.
Sinker (concrete)	3,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1.4 nm
Radar Range	0.5 nm
Mooring Depth (min.)	15 ft.

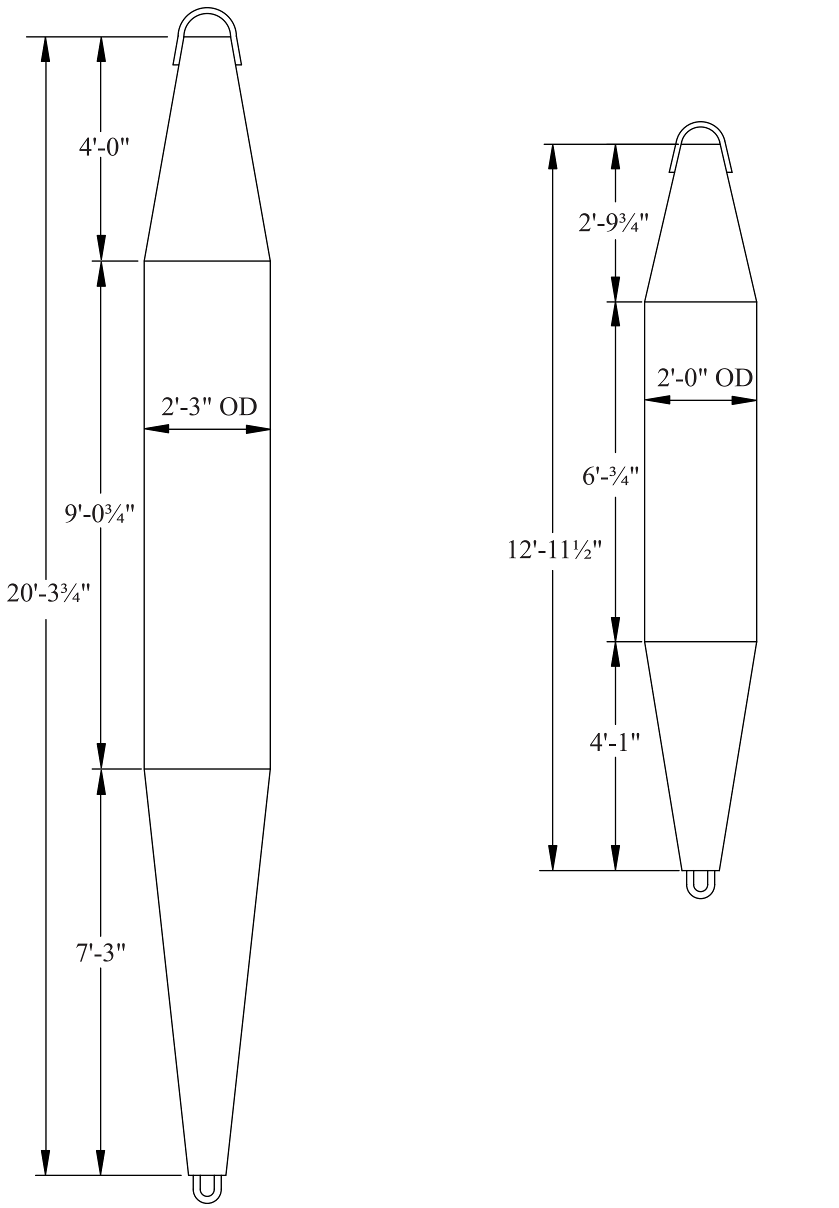
Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1"	27'
7/8"	35'
3/4"	48'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121028
G-SEC Specification No. 464

Data Sheet 2.K.19. 3NI Buoy.

2.K.19. b. Non-Standard Buoys.



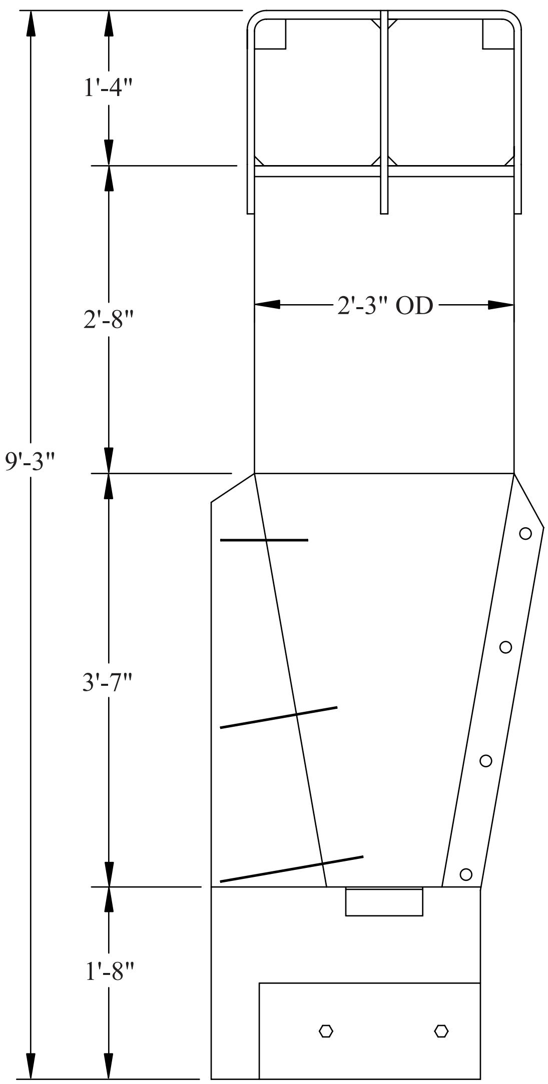
1942 TYPE
1NS
WEIGHT: 2,035 LBS
DRAWING: BU-43-26

1942 TYPE
2NS
WEIGHT: 995 LBS
DRAWING: BU-43-26

Data Sheet 2.K.19. (cont'd).

2.K. 20. 4CR. The 4CR is designed and constructed for use in rivers and other waterways where unlighted lateral buoys are required. The buoys are designed to shed debris and have multiple mooring eyes to remain vertical in a variety of fast water situations. These buoys are filled with polyurethane foam. Non-standard buoys are no longer in use.

a. Standard Buoy Arrangement. 1988 Type 4CR.



Physical Characteristics. (no mooring)

Buoy Weight	465 lbs.
Buoy Draft	5 ft.
Freeboard	2 ft. 11 in.
Minimum Freeboard	1 ft.
Pounds-Per-Inch Immersion	21

Related Equipment.

Mooring Chain	1/2 in.
Mooring Wire Rope	1/2 in.
Sinker (concrete)	2,000 lbs.

Operational Characteristics. (nominal)

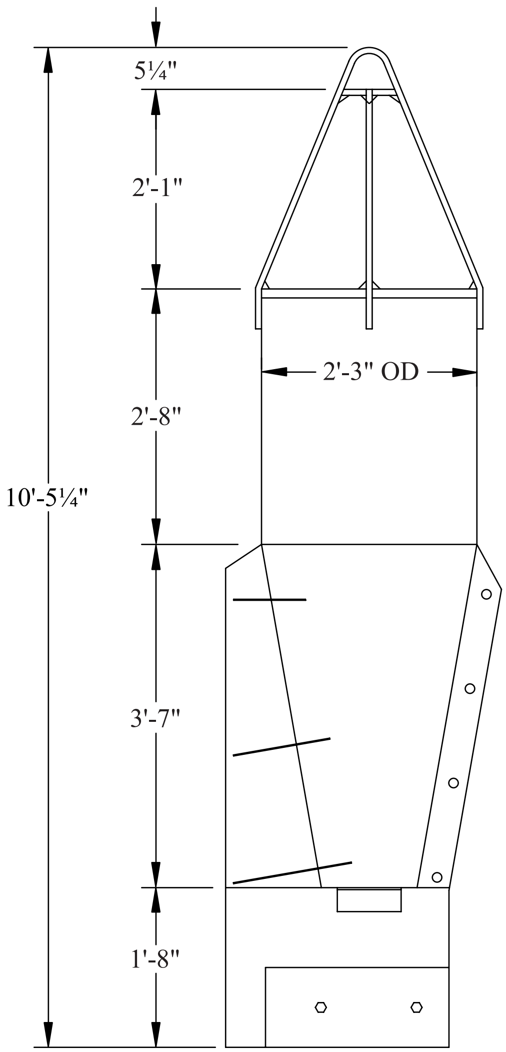
Daymark Visual Range	1.4 nm
Radar Range	1.5 nm
Mooring Depth (min.)	10 ft.
Mooring Depth (max. w/chain)	115 ft.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121117
G-SEC Specification No. 455

Data Sheet 2.K.20. 4CR Buoy.

2.K. 21. 4NR. The 4NR is designed and constructed for use in rivers and other waterways where unlighted lateral buoys are required. The buoys are designed to shed debris and have multiple mooring eyes to remain vertical in a variety of fast water situations. These buoys are filled with polyurethane foam. Non-standard buoys are no longer in use.

a. Standard Buoy Arrangement. 1988 Type 4NR.



Physical Characteristics. (no mooring)

Buoy Weight	470 lbs.
Buoy Draft	5 ft.
Freeboard	2 ft. 11 in.
Minimum Freeboard	1 ft.
Pounds-Per-Inch Immersion	21

Related Equipment.

Mooring Chain	1/2 in.
Mooring Wire Rope	1/2 in.
Sinker (concrete)	2,000 lbs.

Operational Characteristics. (nominal)

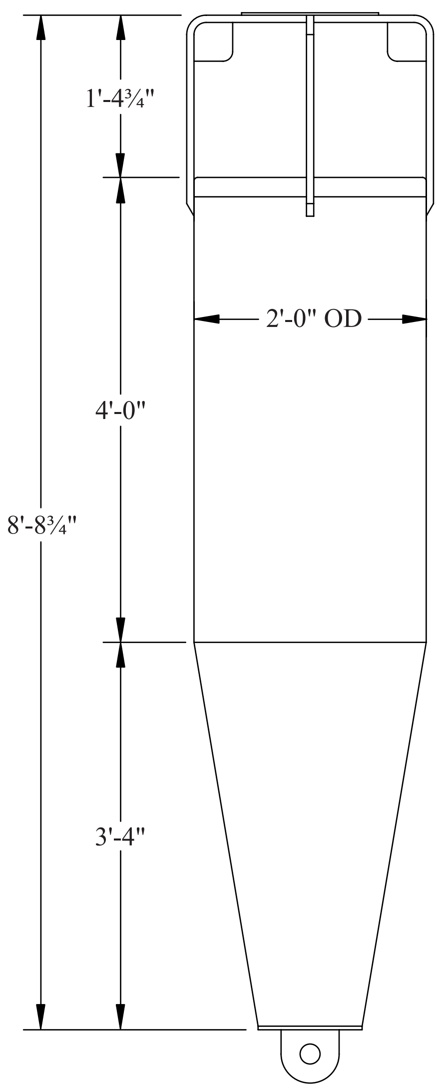
Daymark Visual Range	1.4 nm
Radar Range	1.5 nm
Mooring Depth (min.)	10 ft.
Mooring Depth (max. w/chain)	115 ft.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121116
G-SEC Specification No. 455

Data Sheet 2.K.21. 4NR Buoy.

2.K. 22. 5CR. The 5CR is designed and constructed for protected locations where unlighted lateral buoys are required.

a. Standard Buoy Arrangement. 1994 Type 5CR.



Physical Characteristics. (no mooring)

Buoy Weight	710 lbs.
Buoy Draft	5 ft. 1 in.
Freeboard	2 ft. 3 in.
Minimum Freeboard	11 in.
Pounds-Per-Inch Immersion	16

Related Equipment.

Mooring Chain	1/2 in.
Sinker (concrete)	2,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1.2 nm
Radar Range	1.25 nm
Mooring Depth (min.)	10 ft.

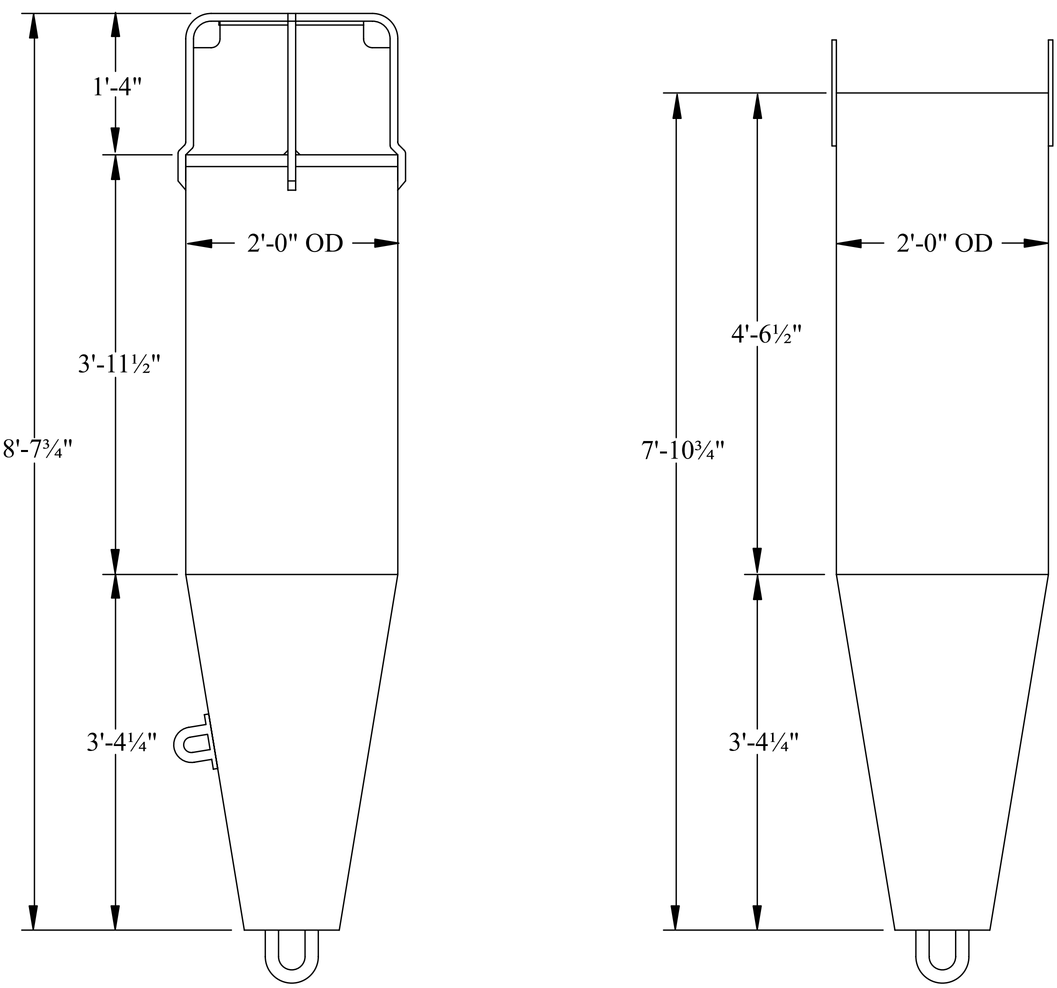
Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1/2"	67'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121164
G-SEC Specification No. 464

Data Sheet 2.K.22. 5CR Buoy.

2.K.22. b. Non-Standard Buoys.



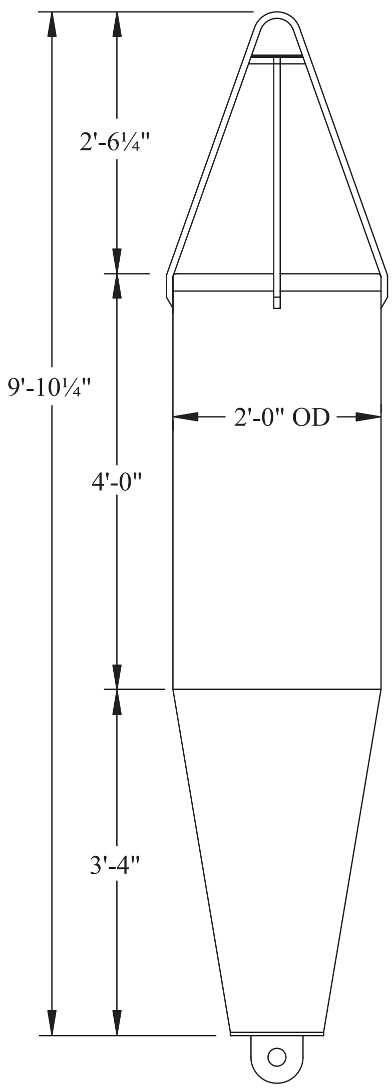
1952 TYPE
5CR
WEIGHT: 680 LBS
DRAWING: 1033

1942 TYPE
5C
WEIGHT: 665 LBS
DRAWING: BU-43-26

Data Sheet 2.K.22. (cont'd).

2.K. 23. 5NR. The 5NR is designed and constructed for protected locations where unlighted lateral buoys are required.

a. Standard Buoy Arrangement. 1994 Type 5NR.



Physical Characteristics. (no mooring)

Buoy Weight	710 lbs.
Buoy Draft	5 ft. 1 in.
Freeboard	2 ft. 3 in.
Minimum Freeboard	11 in.
Pounds-Per-Inch Immersion	16

Related Equipment.

Mooring Chain	1/2 in.
Sinker (concrete)	2,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1.2 nm
Radar Range	1.25 nm
Mooring Depth (min.)	10 ft.

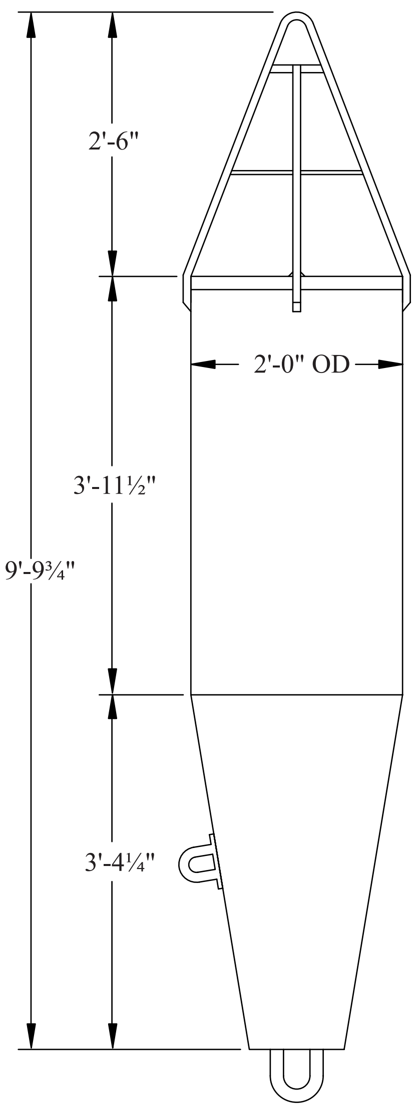
Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1/2"	67'

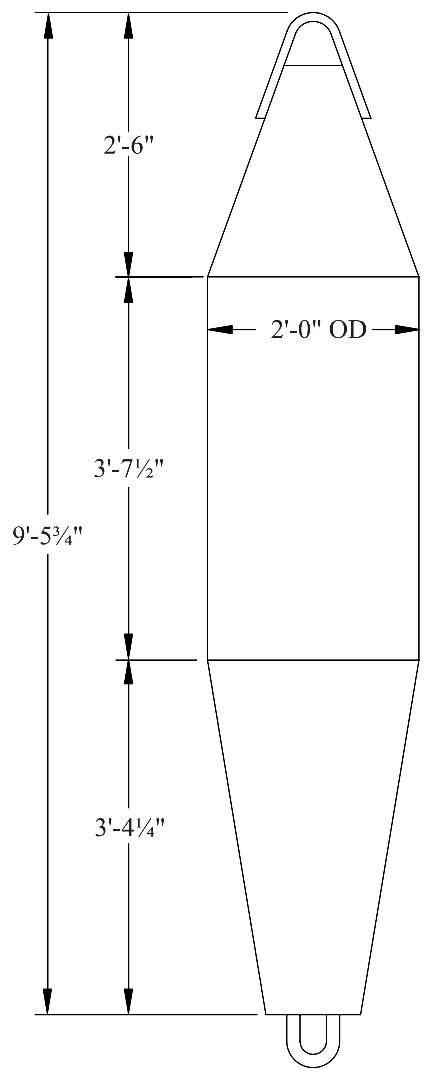
Reference Documents. (use latest rev.)
G-SEC Drawing No. 121163
G-SEC Specification No. 464

Data Sheet 2.K.23. 5NR Buoy.

2.K.23. b. <u>Non-Standard Buoys</u>.



1952 TYPE
5NR
WEIGHT: 690 LBS
DRAWING: 1033

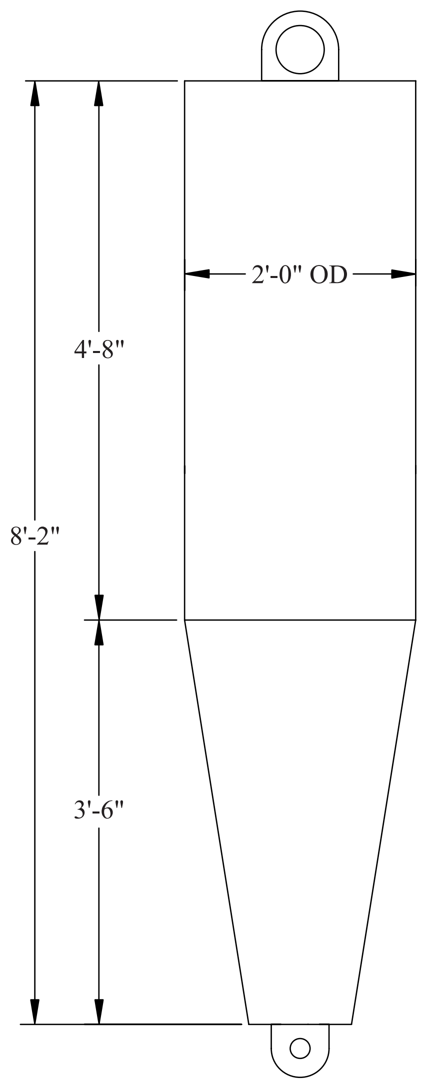


1942 TYPE
5N
WEIGHT: 680 LBS
DRAWING: BU-43-26

Data Sheet 2.K.23. (cont'd).

2.K. 24. 5CI. The 5CI is designed and constructed for locations susceptible to ice where unlighted lateral buoys are required. Note the buoy does not have a radar reflector.

a. Standard Buoy Arrangement. 1981 Type 5CI.



Physical Characteristics. (no mooring)

Buoy Weight	700 lbs.
Buoy Draft	5 ft. 0 in.
Freeboard	3 ft. 2 in.
Minimum Freeboard	2 ft. 2 in.
Pounds-Per-Inch Immersion	16

Related Equipment.

Mooring Chain	1/2 in.
Sinker (concrete)	2,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1.2 nm
Radar Range	0.5 nm
Mooring Depth (min.)	10 ft.

Maximum Mooring Depth.

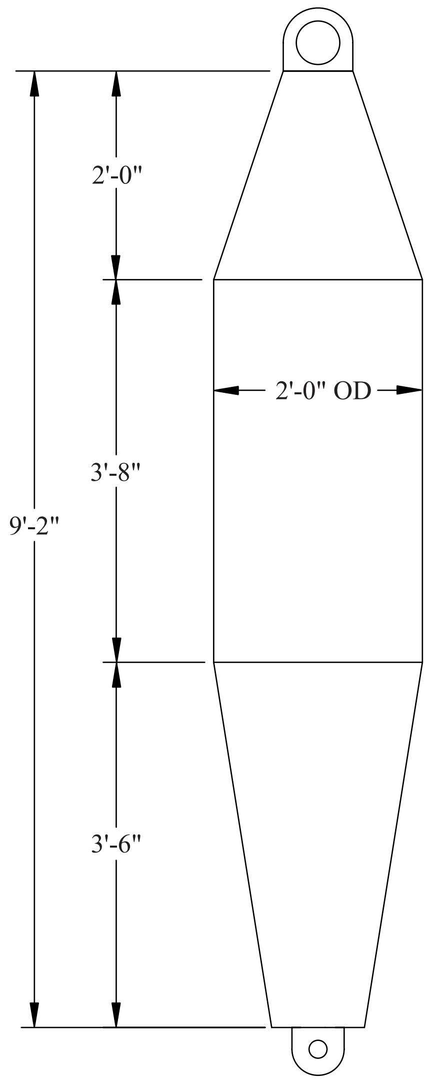
Chain Size	Max Mooring Depth
1/2"	50'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 120990
G-SEC Specification No. 464

Data Sheet 2.K.24. 5CI Buoy.

2.K. 25. 5NI. The 5NI is designed and constructed for locations susceptible to ice where unlighted lateral buoys are required. Note the buoy does not have a radar reflector.

a. Standard Buoy Arrangement. 1981 Type 5NI.



Physical Characteristics. (no mooring)

Buoy Weight	700 lbs.
Buoy Draft	5 ft. 0 in.
Freeboard	4 ft. 2 in.
Minimum Freeboard	3 ft. 2 in.
Pounds-Per-Inch Immersion	16

Related Equipment.

Mooring Chain	1/2 in.
Sinker (concrete)	2,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1.2 nm
Radar Range	0.5 nm
Mooring Depth (min.)	10 ft.

Maximum Mooring Depth.

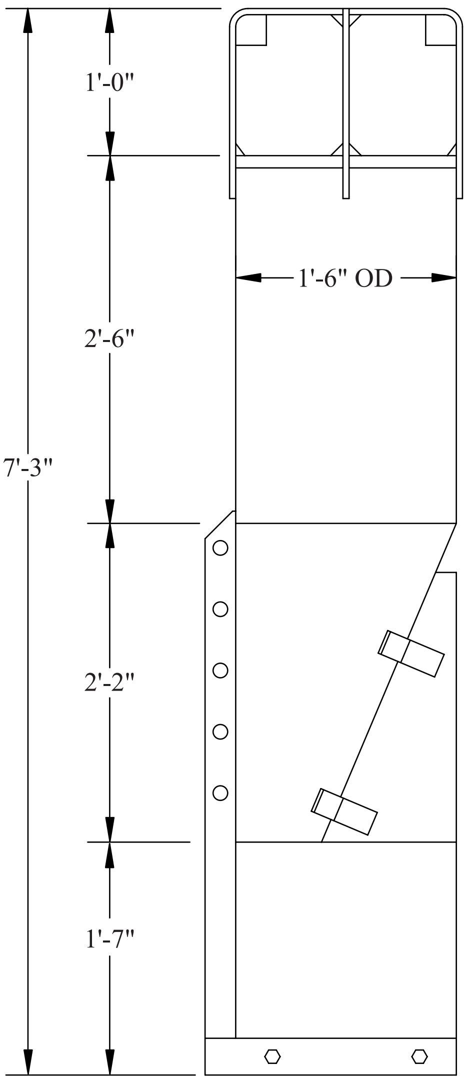
Chain Size	Max Mooring Depth
1/2"	50'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 120990
G-SEC Specification No. 464

Data Sheet 2.K.25. 5NI Buoy.

2.K. 26. 6CR. The 6CR is designed and constructed for use in rivers and other waterways where unlighted lateral buoys are required. The buoys are designed to shed debris and have multiple mooring eyes to remain vertical in a variety of fast water situations. These buoys are filled with polyurethane foam. Non-standard buoys are no longer in use.

a. Standard Buoy Arrangement. 1988 Type 6CR.



Physical Characteristics. (no mooring)

Buoy Weight	160 lbs.
Buoy Draft	3 ft. 10 in.
Freeboard	2 ft. 5 in.
Minimum Freeboard	6 in.
Pounds-Per-Inch Immersion	9

Related Equipment.

Mooring Chain	1/2 in.
Mooring Wire Rope	3/8 in.
Sinker (concrete)	500 lbs.

Operational Characteristics. (nominal)

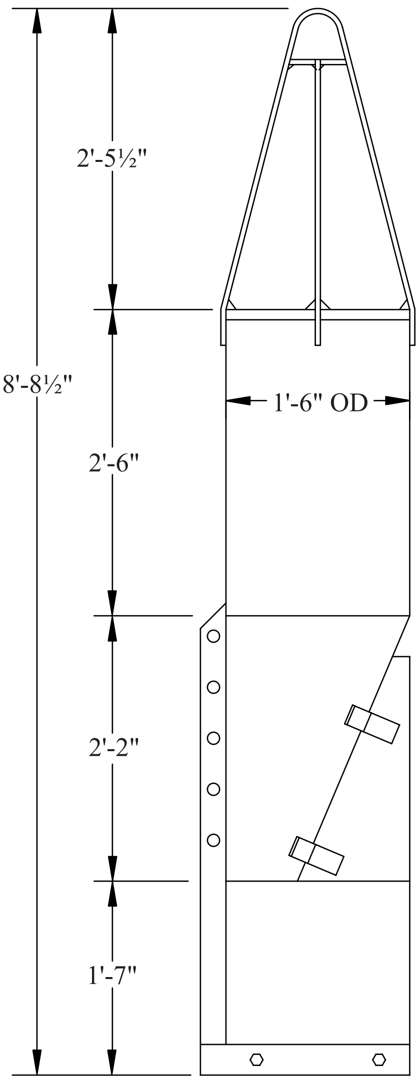
Daymark Visual Range	1 nm
Radar Range	1 nm
Mooring Depth (min.)	6 ft.
Mooring Depth (max. w/chain)	60 ft.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121119
G-SEC Specification No. 455

Data Sheet 2.K.26. 6CR Buoy.

2.K. 27. 6NR. The 6NR is designed and constructed for use in rivers and other waterways where unlighted lateral buoys are required. The buoys are designed to shed debris and have multiple mooring eyes to remain vertical in a variety of fast water situations. These buoys are filled with polyurethane foam. Non-standard buoys are no longer in use.

a. Standard Buoy Arrangement. 1988 Type 6NR.



Physical Characteristics. (no mooring)

Buoy Weight	165 lbs.
Buoy Draft	3 ft. 10 in.
Freeboard	2 ft. 5 in.
Minimum Freeboard	6 in.
Pounds-Per-Inch Immersion	9

Related Equipment.

Mooring Chain	1/2 in.
Mooring Wire Rope	3/8 in.
Sinker (concrete)	500 lbs.

Operational Characteristics. (nominal)

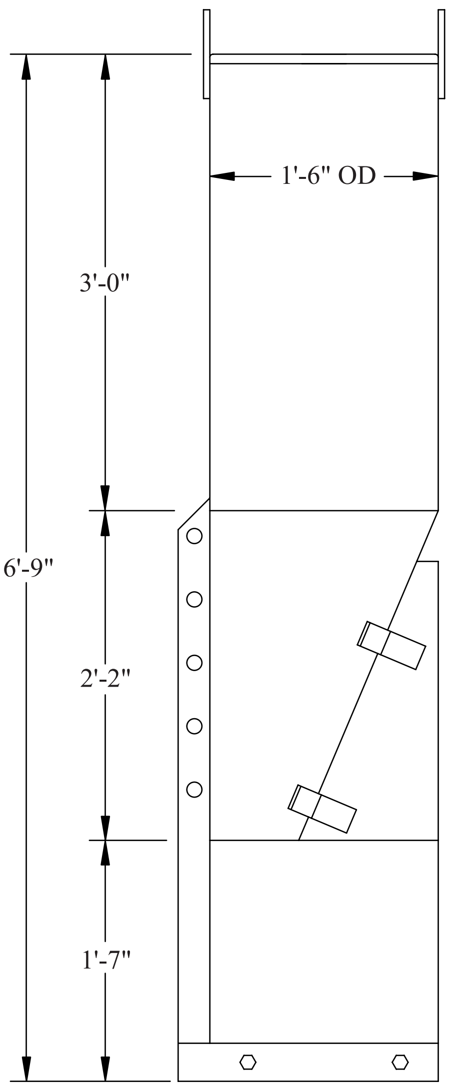
Daymark Visual Range	1 nm
Radar Range	1 nm
Mooring Depth (min.)	6 ft.
Mooring Depth (max. w/chain)	60 ft.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121118
G-SEC Specification No. 455

Data Sheet 2.K.27. 6NR Buoy.

2.K. 28. 6CT. The 6CT is designed and constructed for use in the swiftest western rivers where unlighted lateral buoys are required. This "tall type" buoy has no radar reflector. The buoys are designed to shed debris and have multiple mooring eyes to remain vertical in a variety of fast water situations. These buoys are filled with polyurethane foam. Non-standard buoys are no longer in use.

a. Standard Buoy Arrangement. 1988 Type 6CT.



Physical Characteristics. (no mooring)

Buoy Weight	165 lbs.
Buoy Draft	4 ft.
Freeboard	2 ft. 9 in.
Minimum Freeboard	1 ft. 6 in.
Pounds-Per-Inch Immersion	9

Related Equipment.

Mooring Chain	1/2 in.
Mooring Wire Rope	3/8 in.
Sinker (concrete)	500 lbs.

Operational Characteristics. (nominal)

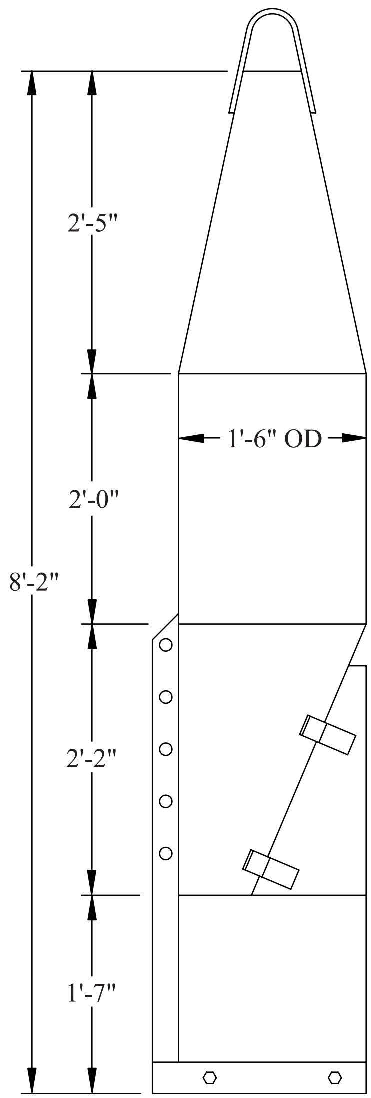
Daymark Visual Range	1 nm
Radar Range	0.5 nm
Mooring Depth (min.)	6 ft.
Mooring Depth (max. w/chain)	37 ft.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121121
G-SEC Specification No. 455

Data Sheet 2.K.28. 6CT Buoy.

2.K. 29. 6NT. The 6NT is designed and constructed for use in the swiftest western rivers where unlighted lateral buoys are required. This "tall type" buoy has no radar reflector. The buoys are designed to shed debris and have multiple mooring eyes to remain vertical in a variety of fast water situations. These buoys are filled with polyurethane foam. Non-standard buoys are no longer in use.

a. Standard Buoy Arrangement. 1988 Type 6NT.



Physical Characteristics. (no mooring)

Buoy Weight	170 lbs.
Buoy Draft	4 ft.
Freeboard	4 ft. 2 in.
Minimum Freeboard	2 ft. 6 in.
Pounds-Per-Inch Immersion	9

Related Equipment.

Mooring Chain	1/2 in.
Mooring Wire Rope	3/8 in.
Sinker (concrete)	500 lbs.

Operational Characteristics. (nominal)

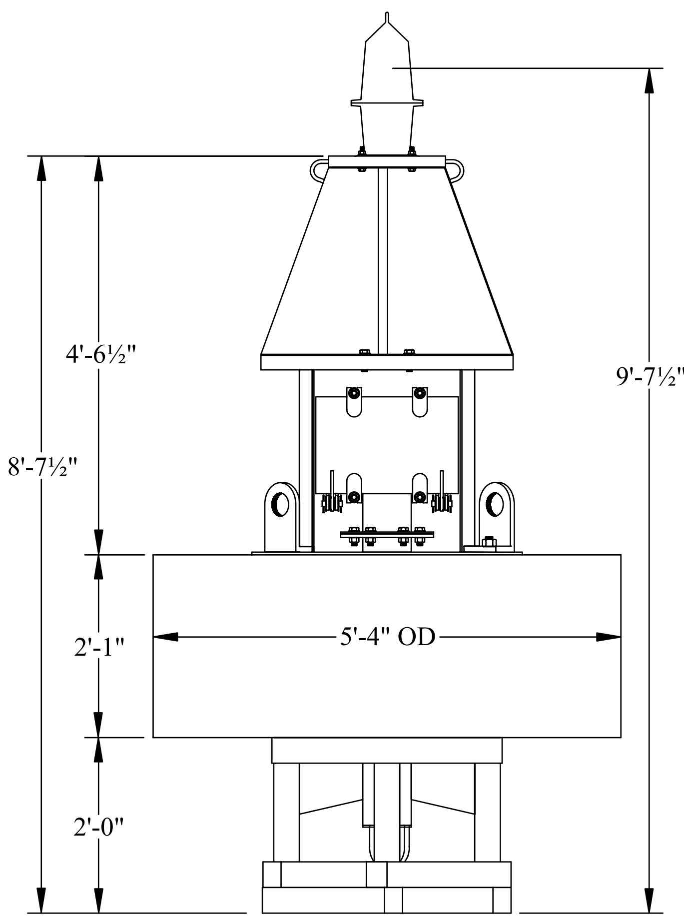
Daymark Visual Range	1 nm
Radar Range	0.5 nm
Mooring Depth (min.)	6 ft.
Mooring Depth (max. w/chain)	49 ft.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121120
G-SEC Specification No. 455

Data Sheet 2.K.29. 6NT Buoy.

2.K. 30. 5X9LFR. The 5X9LFR is designed and constructed for protected locations. It is designed for use as a shallow water lighted buoy. The aluminum radar reflector has lateral significance. Can and nun tops are available. The buoy hull is constructed of concentrically-wrapped sheets of ionomer foam with a "densified" outer surface for abrasion resistance. The tower and structural members are steel. This buoy is not suitable for use where ice is present.

a. Standard Buoy Arrangements. 1991 Type 5X9LFR.



Physical Characteristics. (no mooring)

Buoy Weight	1,500 lbs.
Buoy Draft	2 ft. 9 in.
Focal Height of Light	6 ft. 7 in.
Freeboard	1 ft. 1 in.
Minimum Freeboard	5 in.
Pounds-Per-Inch Immersion	119

Related Equipment.

Mooring Chain	3/4 in.
Sinker (concrete)	4,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1.4 nm
Radar Range	1.3 nm
Mooring Depth (min.)	10 ft.

Maximum Mooring Depth.

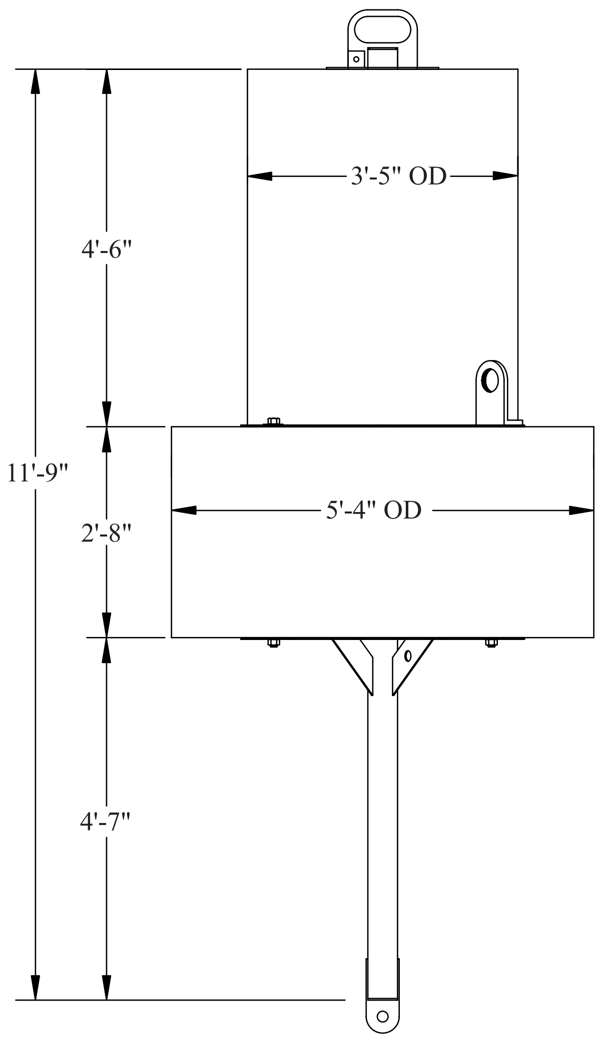
Chain Size	Max Mooring Depth
1"	62'
7/8"	81'
3/4"	110'

Reference Documents. (use latest rev.)
G-SEC Drawings:
Complete Buoy No. 121148
Nun Radar Reflector No. 120316
Can Radar Reflector No. 121024
G-SEC Specification No. 450

Data Sheet 2.K.30. 5X9LFR Buoy.

2.K. 31. 2CFR. The 2CFR is designed and constructed for exposed locations where unlighted lateral buoys are required. This buoy is constructed of concentrically-wrapped sheets of ionomer foam with a "densified" outer surface for abrasion resistance. The structural members are steel. The radar reflector is internal. This buoy is not suitable for use where ice is present.

a. Standard Buoy Arrangement. 1995 Type 2CFR.



Physical Characteristics. (no mooring)

Buoy Weight	1,100 lbs.
Buoy Draft	5 ft. 3 in.
Freeboard	2 ft.
Minimum Freeboard	10 in.
Pounds-Per-Inch Immersion	119

Related Equipment.

Mooring Chain	3/4 in.
Sinker (concrete)	3,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	2.6 nm
Radar Range	1.5 nm
Mooring Depth (min.)	15 ft.

Maximum Mooring Depth.

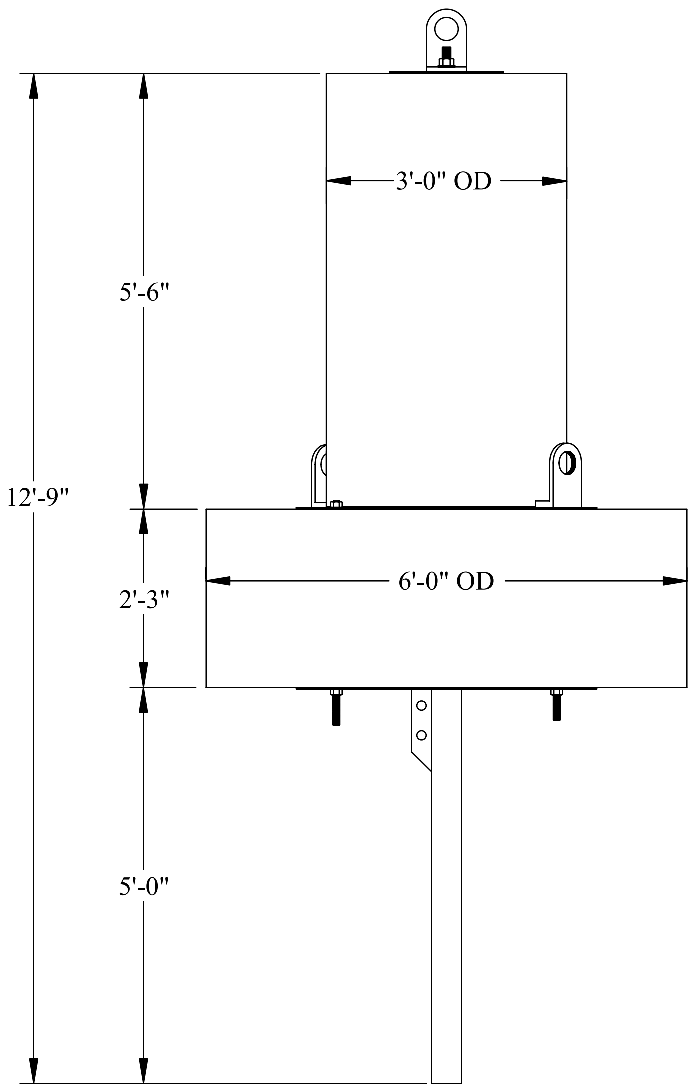
Chain Size	Max Mooring Depth
1 1/8"	91'
1"	115'
7/8"	149'
3/4"	204'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121166
G-SEC Specification No. 450

Assembly Instructions.
1. See general assembly guidelines in paragraph 2.F.1.
2. Slide foam daymark onto the center pipe (retro up).
3. Push the top plate firmly against the daymark. Bolt the top plate to the top support gussets just below the lifting eye. Washers shall be placed between the bolt head and the gusset as well as between the lock nut and the gusset.

Data Sheet 2.K.31. 2CFR Buoy.

2.K.31. b. Non-Standard Buoy.

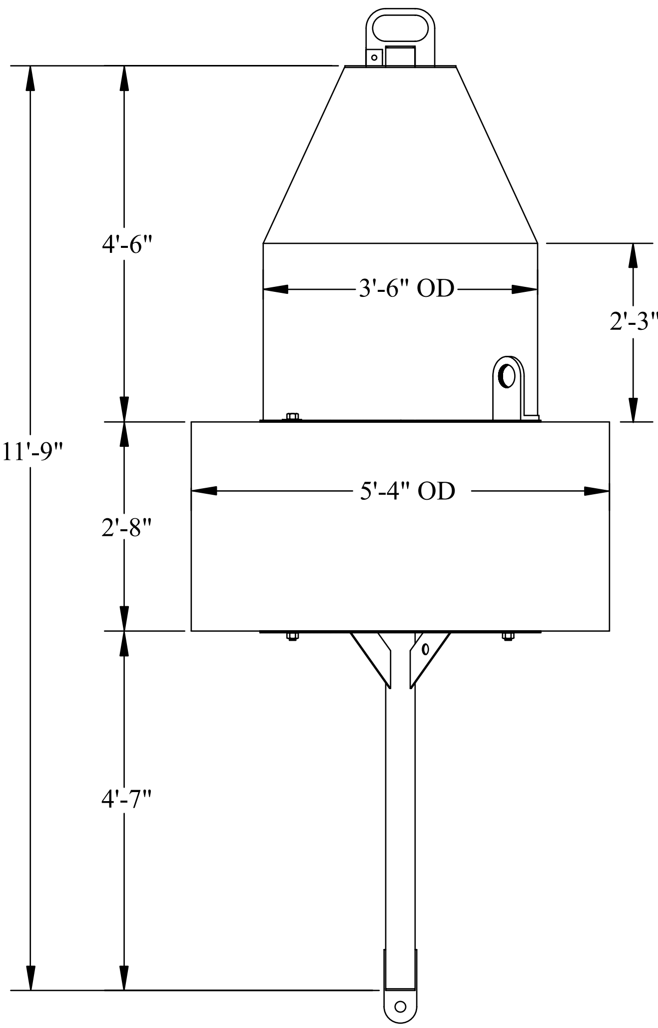


1989 TYPE
2CFR
BUOY WEIGHT: 820 lbs
DRAWING: 121122

Data Sheet 2.K.31. (cont'd).

2.K. 32. 2NFR. The 2NFR is designed and constructed for exposed locations where unlighted lateral buoys are required. This buoy is constructed of concentrically-wrapped sheets of ionomer foam with a "densified" outer surface for abrasion resistance. The structural members are steel. The radar reflector is internal. This buoy is not suitable for use where ice is present.

a. Standard Buoy Arrangement. 1995 Type 2NFR.



Physical Characteristics. (no mooring)

Buoy Weight	1,025 lbs.
Buoy Draft	5 ft. 3 in.
Freeboard	2 ft.
Minimum Freeboard	10 in.
Pounds-Per-Inch Immersion	119

Related Equipment.

Mooring Chain	3/4 in.
Sinker (concrete)	3,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	2.6 nm
Radar Range	1.5 nm
Mooring Depth (min.)	15 ft.

Maximum Mooring Depth.

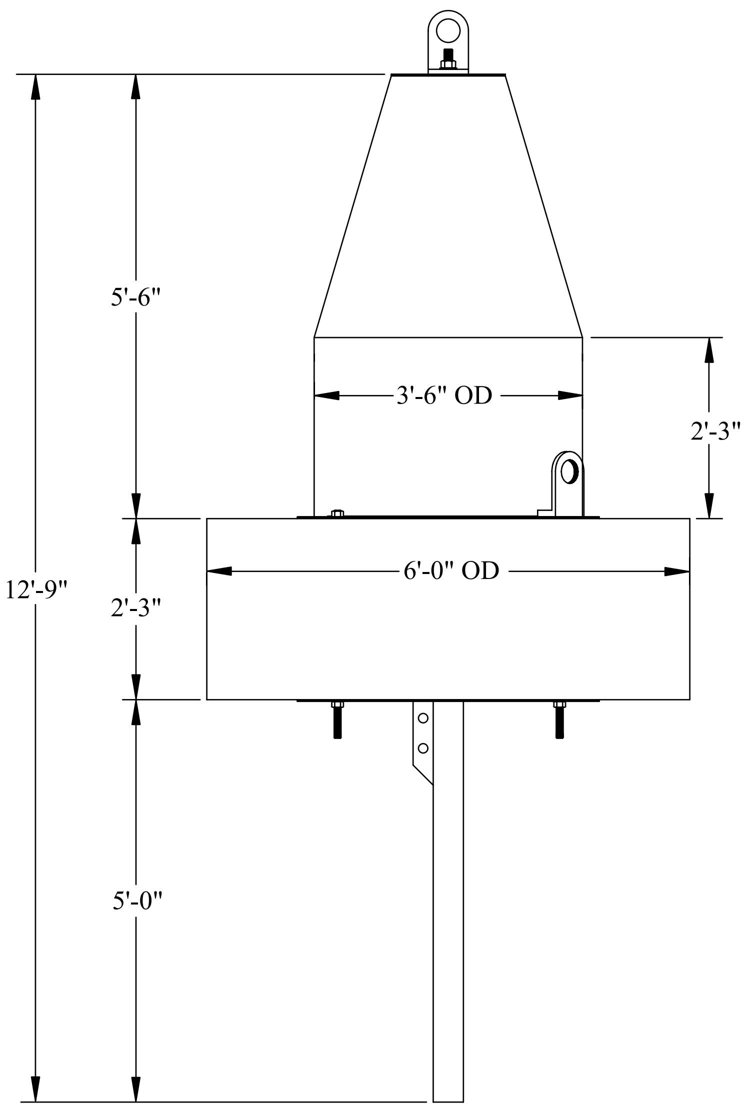
Chain Size	Max Mooring Depth
1-1/8"	91'
1"	115'
7/8"	149'
3/4"	204'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121166
G-SEC Specification No. 450

Assembly Instructions.
1. See general assembly guidelines in paragraph 2.F.1.
2. Slide foam daymark onto the center pipe (retro up).
3. Push the top plate firmly against the daymark. Bolt the top plate to the top support gussets just below the lifting eye. Washers shall be placed between the bolt head and the gusset as well as between the lock nut and the gusset.

Data Sheet 2.K.32. 2NFR Buoy.

2.K.32. b. Non-Standard Buoy.

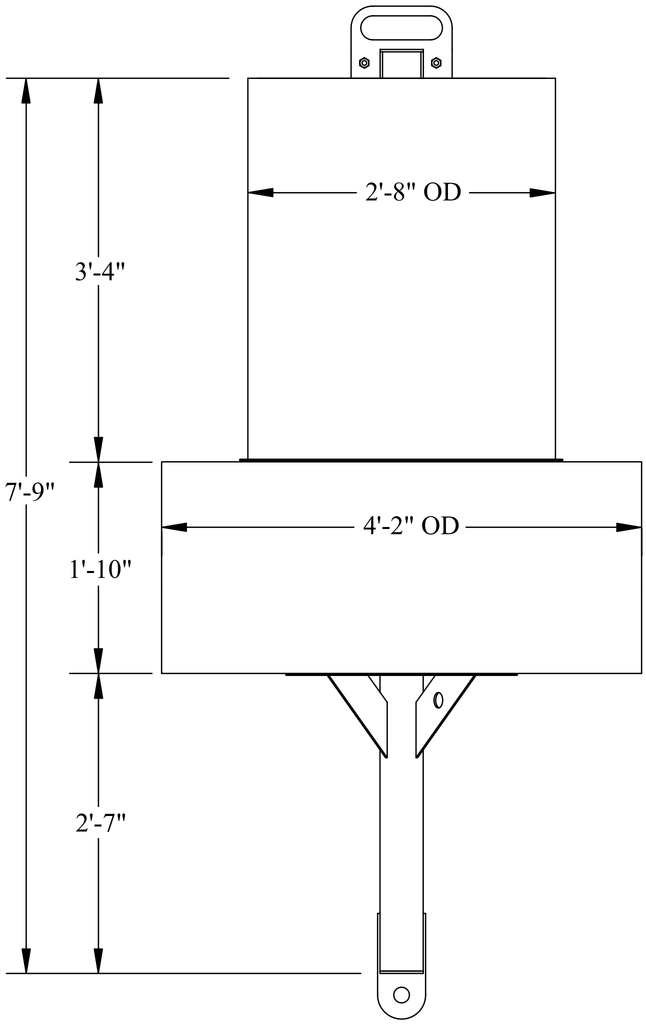


1989 TYPE
2NFR
BUOY WEIGHT: 820 lbs
DRAWING NO.: 121122

Data Sheet 2.K.32. (cont'd).

2.K. 33. 3CFR. The 3CFR is designed and constructed for semi-exposed locations where unlighted lateral buoys are required. This buoy is constructed of concentrically-wrapped sheets of ionomer foam with a "densified" outer surface for abrasion resistance. The structural members are steel. The radar reflector is internal. This buoy is not suitable for use where ice is present.

a. Standard Buoy Arrangement. 1995 Type 3CFR.



Physical Characteristics. (no mooring)

Buoy Weight	525 lbs.
Buoy Draft	3 ft. 1 in.
Freeboard	1 ft. 4 in.
Minimum Freeboard	6 in.
Pounds-Per-Inch Immersion	72

Related Equipment.

Mooring Chain	1/2 in.
Sinker (concrete)	2,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	2.0 nm
Radar Range	1.5 nm
Mooring Depth (min.)	10 ft.

Maximum Mooring Depth.

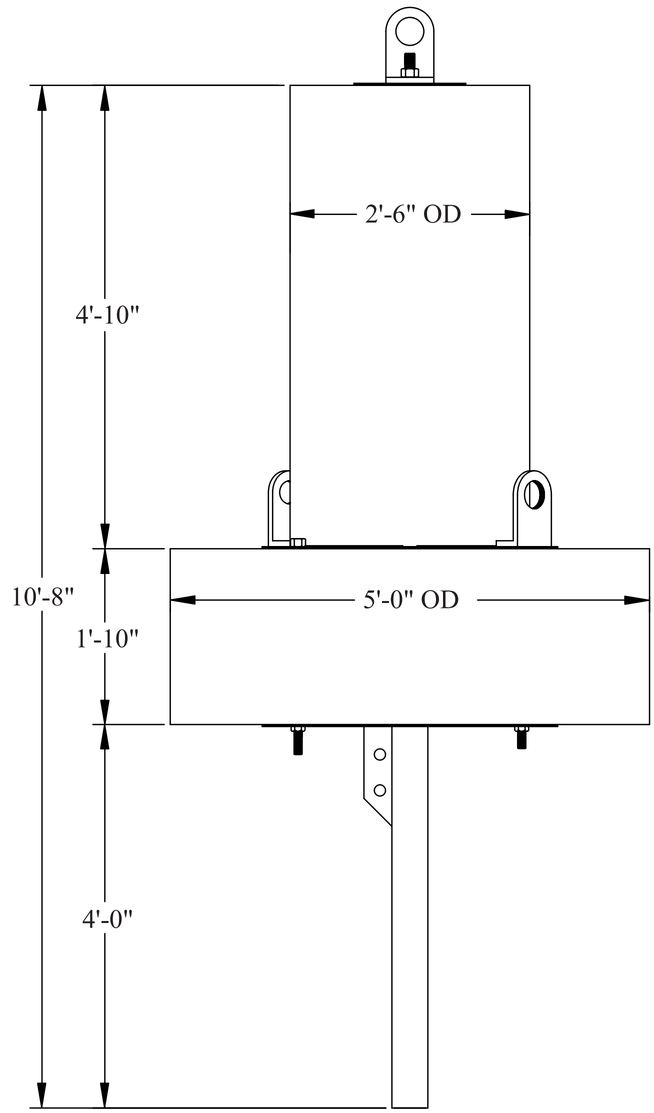
Chain Size	Max Mooring Depth
7/8"	60'
3/4"	82'
1/2"	179'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121167
G-SEC Specification No. 450

Assembly Instructions.
1. See general assembly guidelines in paragraph 2.F.1.
2. Slide foam daymark onto the center pipe (retro up).
3. Push the top plate firmly against the daymark. Bolt the top plate to the top support gussets just below the lifting eye. Washers shall be placed between the bolt head and the gusset as well as between the lock nut and the gusset.

Data Sheet 2.K.33. 3CFR Buoy.

2.K.33. b. Non-Standard Buoy.

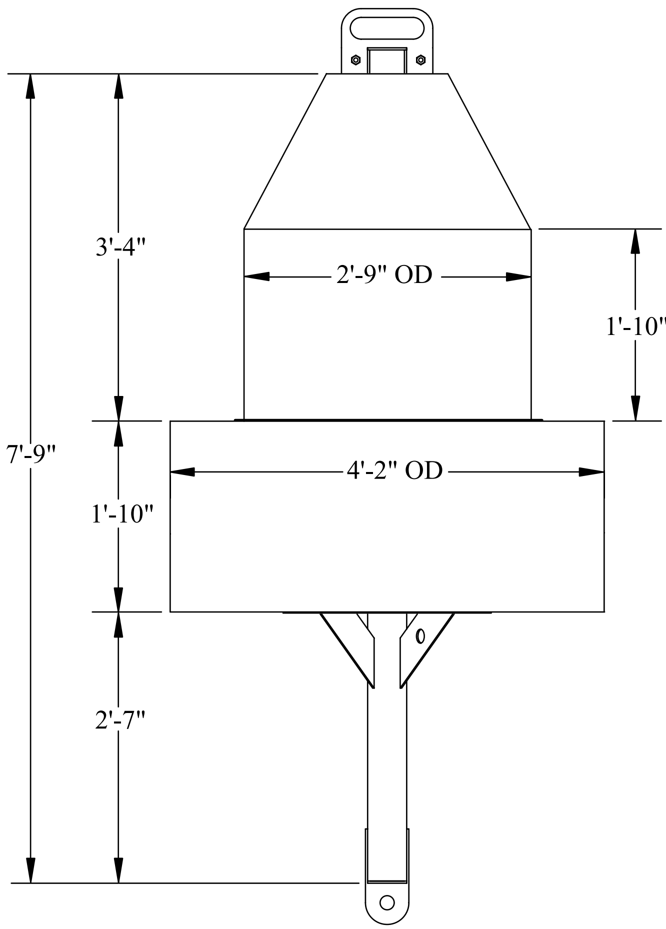


1989 TYPE
3CFR
BUOY WEIGHT: 530 lbs
DRAWING NO.: 121123

Data Sheet 2.K.33. (cont'd).

2.K. 34. 3NFR. The 3NFR is designed and constructed for semi-exposed locations where unlighted lateral buoys are required. This buoy is constructed of concentrically-wrapped sheets of ionomer foam with a "densified" outer surface for abrasion resistance. The structural members are steel. The radar reflector is internal. This buoy is not suitable for use where ice is present.

a. Standard Buoy Arrangement. 1995 Type 3NFR.



Physical Characteristics. (no mooring)

Buoy Weight	500 lbs.
Buoy Draft	3 ft. 1 in.
Freeboard	1 ft. 4 in.
Minimum Freeboard	6 in.
Pounds-Per-Inch Immersion	72

Related Equipment.

Mooring Chain	1/2 in.
Sinker (concrete)	2,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	2.0 nm
Radar Range	1.5 nm
Mooring Depth (min.)	10 ft.

Maximum Mooring Depth.

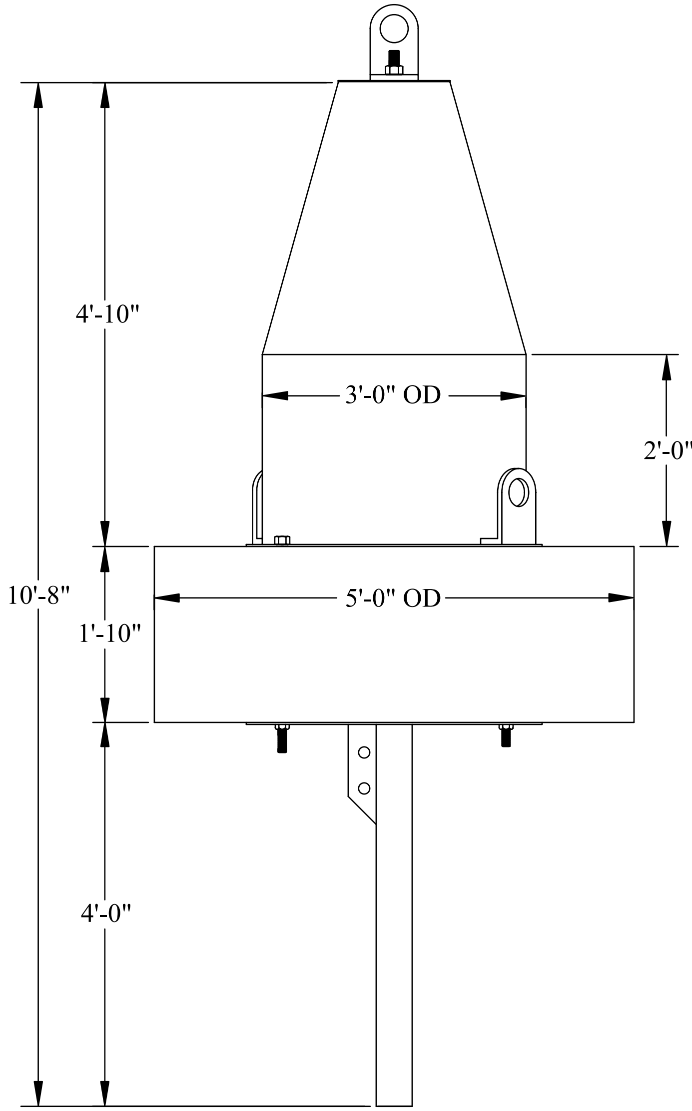
Chain Size	Max Mooring Depth
7/8"	60'
3/4"	82'
1/2"	179'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121167
G-SEC Specification No. 450

Assembly Instructions.
1. See general assembly guidelines in paragraph 2.F.1.
2. Slide foam daymark onto the center pipe (retro up).
3. Push the top plate firmly against the daymark. Bolt the top plate to the top support gussets just below the lifting eye. Washers shall be placed between the bolt head and the gusset as well as between the lock nut and the gusset.

Data Sheet 2.K.34. 3NFR Buoy.

2.K.34. b. <u>Non-Standard Buoy</u>.

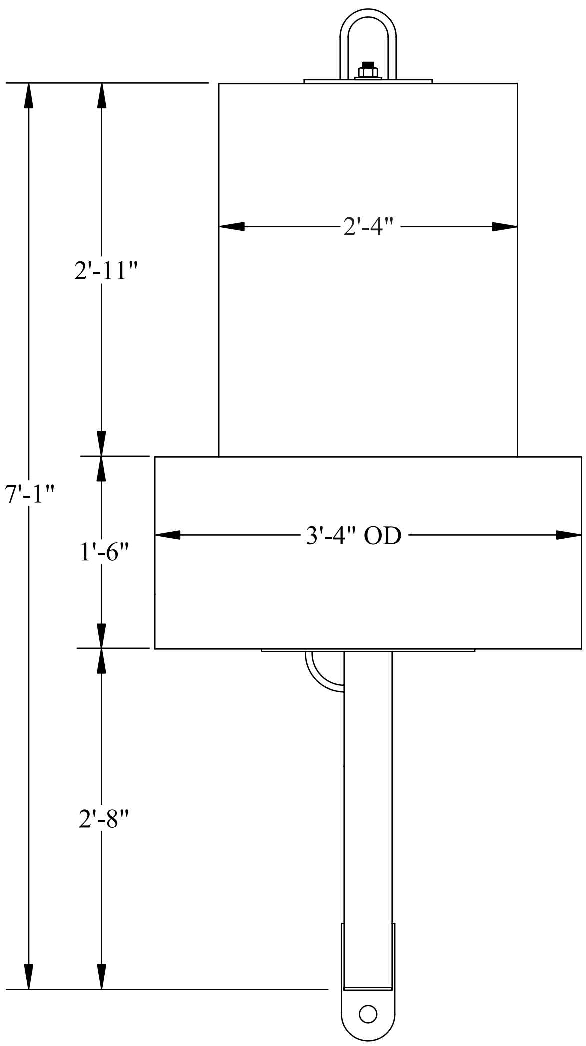


1989 TYPE
3NFR
BUOY WEIGHT: 530 lbs
DRWAING NO.: 121123

Data Sheet 2.K.34. (cont'd).

2.K. 35. 4CFR. The 4CFR is designed and constructed for semi-exposed locations where unlighted lateral buoys are required. This buoy is constructed of concentrically-wrapped sheets of ionomer foam with a "densified" outer surface for abrasion resistance. The structural members are galvanized steel. The radar reflector is internal. This buoy is not suitable for use where ice is present.

a. Standard Buoy Arrangement. 1995 Type 4CFR.



Physical Characteristics. (no mooring)

Buoy Weight	195 lbs.
Buoy Draft	2 ft. 10 in.
Freeboard	11 in.
Minimum Freeboard	4 in.
Pounds-Per-Inch Immersion	47

Related Equipment.

Mooring Chain	1/2 in.
Sinker (concrete)	1,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1.4 nm
Radar Range	0.75 nm
Mooring Depth (min.)	10 ft.

Maximum Mooring Depth.

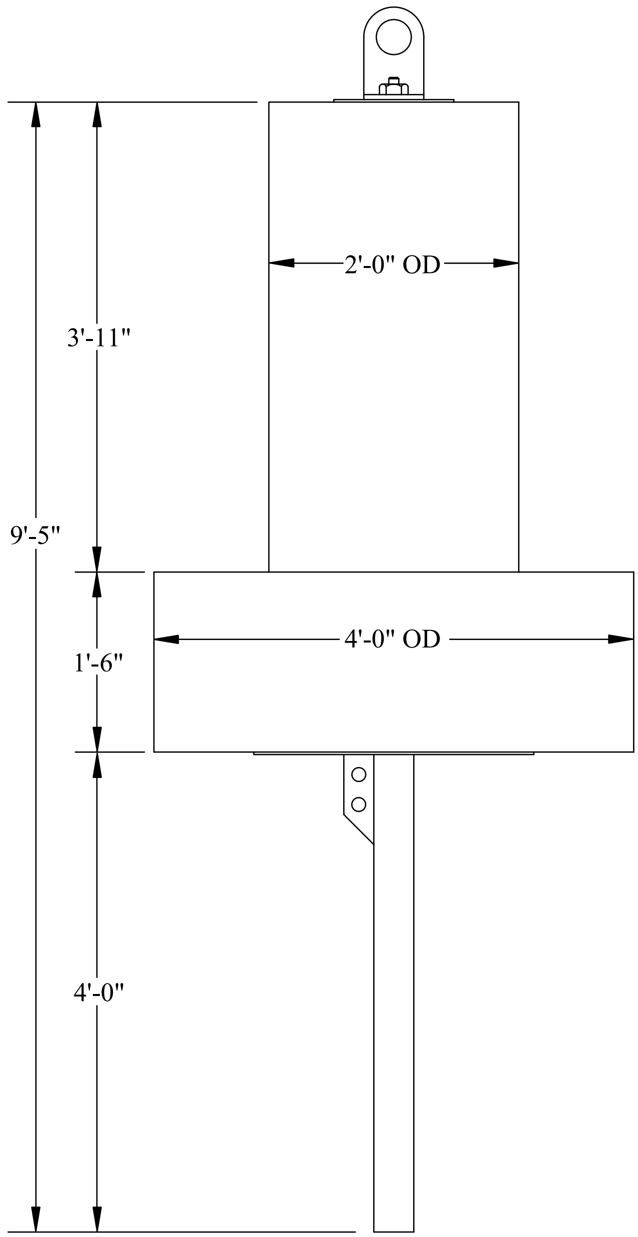
Chain Size	Max Mooring Depth
3/4"	37'
1/2"	80'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121168
G-SEC Specification No. 450

Assembly Instructions.
1. See general assembly guidelines in paragraph 2.F.1.
2. Slide the foam flotation collar and then the foam daymark (retro up) onto the center pipe.
3. Push the lifting eye plate firmly against the daymark. Bolt the lifting eye plate to the top of the center pipe. Place a washer between the lock nut and the lifting eye plate.

Data Sheet 2.K.35. 4CFR Buoy.

2.K.35. b. Non-Standard Buoy.

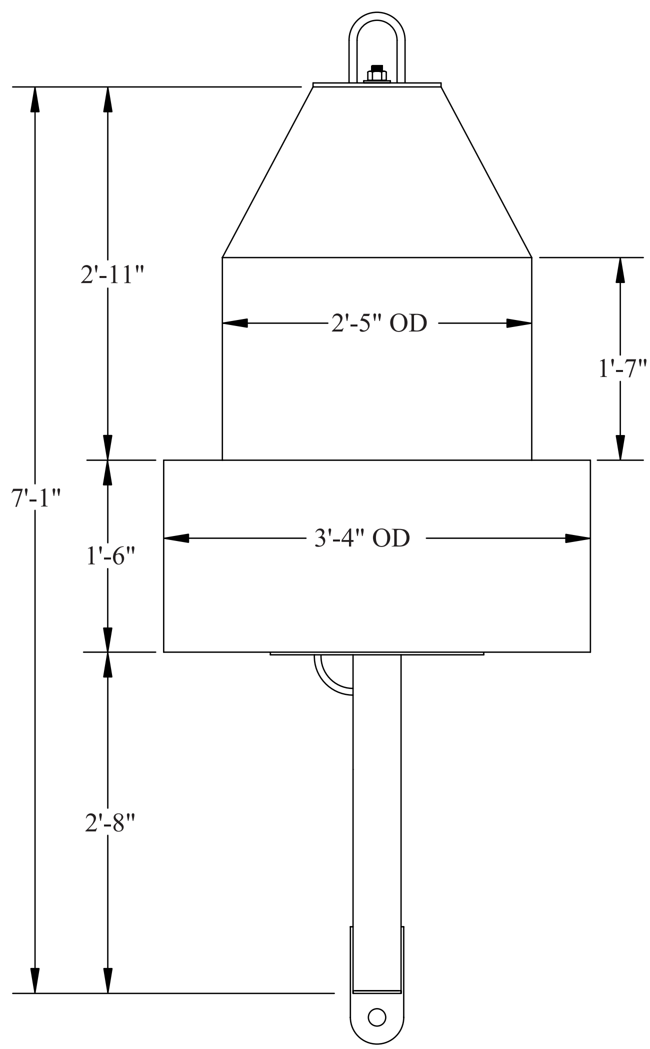


1989 TYPE
4CFR
BUOY WEIGHT: 232 lbs
DRAWING NO.: 121124

Data Sheet 2.K.35. (cont'd).

2.K. 36. 4NFR. The 4NFR is designed and constructed for semi-exposed locations where unlighted lateral buoys are required. This buoy is constructed of concentrically-wrapped sheets of ionomer foam with a "densified" outer surface for abrasion resistance. The structural members are galvanized steel. The radar reflector is internal. This buoy is not suitable for use where ice is present.

a. Standard Buoy Arrangement. 1995 Type 4NFR.



Physical Characteristics. (no mooring)

Buoy Weight	180 lbs.
Buoy Draft	2 ft. 10 in.
Freeboard	11 in.
Minimum Freeboard	4 in.
Pounds-Per-Inch Immersion	47

Related Equipment.

Mooring Chain	1/2 in.
Sinker (concrete)	1,000 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1.4 nm
Radar Range	0.75 nm
Mooring Depth (min.)	10 ft.

Maximum Mooring Depth.

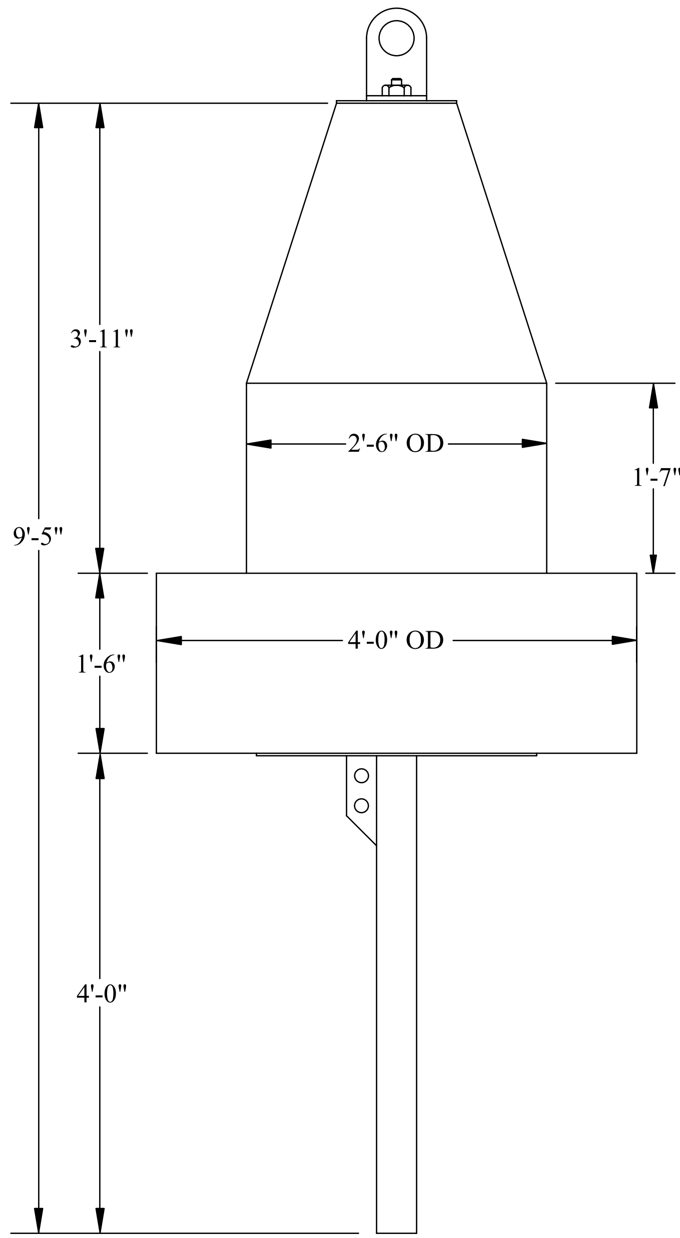
Chain Size	Max Mooring Depth
3/4"	37'
1/2"	80'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121168
G-SEC Specification No. 450

Assembly Instructions.
1. See general assembly guidelines in paragraph 2.F.1.
2. Slide the foam flotation collar and then the foam daymark (retro up) onto the center pipe.
3. Push the lifting eye plate firmly against the daymark. Bolt the lifting eye plate to the top of the center pipe. Place a washer between the lock nut and the lifting eye plate.

Data Sheet 2.K.36. 4NFR Buoy.

2.K.36. b. Non-Standard Buoy.

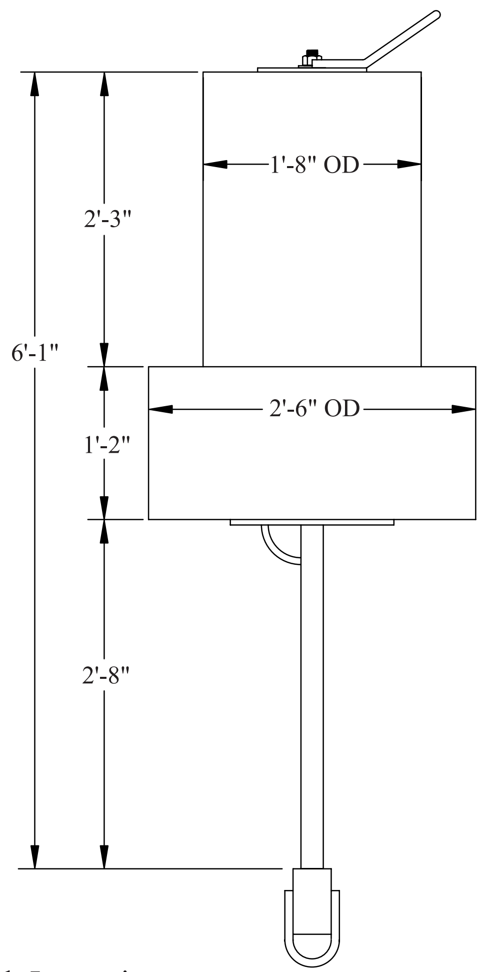


1989 TYPE
4NFR
BUOY WEIGHT: 232 lbs
DRAWING NO.: 121124

Data Sheet 2.K.36. (cont'd).

2.K. 37. 5CFR. The 5CFR is designed and constructed for protected locations where unlighted lateral buoys are required. This buoy is constructed of concentrically-wrapped sheets of ionomer foam with a "densified" outer surface for abrasion resistance. The structural members are galvanized steel. The radar reflector is internal. This buoy is not suitable for use where ice is present. The lifting eye plate is designed to accommodate the self-contained LED lantern described in Chapter 6 of this manual. In this configuration, the 5CFR can be deployed as a lighted discrepancy buoy. This buoy/lantern combination is the authorized replacement for the plastic discrepancy buoy shown on Data Sheet 2.K.45.

a. Standard Buoy Arrangement. 2000 Type 5CFR.



Physical Characteristics. (no mooring)	
Buoy Weight	115 lbs.
Buoy Draft	3 ft. 0 in.
Freeboard	10 in.
Minimum Freeboard	4 in.
Pounds-Per-Inch Immersion	26

Related Equipment.	
Mooring Chain	1/2 in.
Sinker (concrete)	500 lbs.

Operational Characteristics. (nominal)	
Daymark Visual Range	1.2 nm
Radar Range	0.5 nm
Mooring Depth (min)	6 ft.

Maximum Mooring Depth.

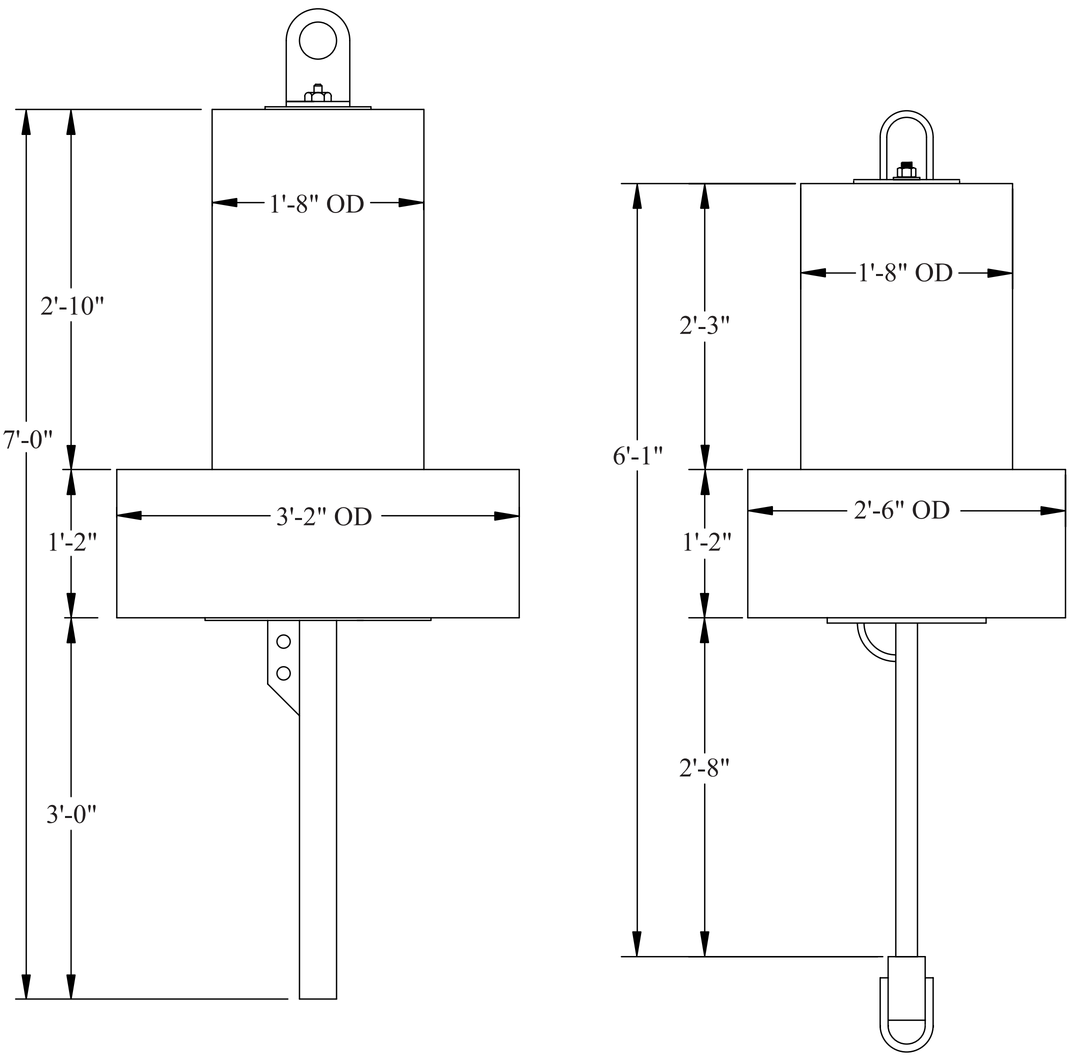
Chain Size	Max Mooring Depth
1/2"	40'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121169
G-SEC Specification No. 450

Assembly Instructions.
1. See general assembly guidelines in paragraph 2.F.1.
2. Slide the foam flotation collar and then the foam daymark (retro up) onto the center pipe.
3. Push the lifting eye plate firmly against the daymark. Bolt the lifting eye plate to the top of the center pipe. Place a washer between the lock nut and the lifting eye plate.

Data Sheet 2.K.37. 5CFR Buoy.

2.K.37. b. Non-Standard Buoy.



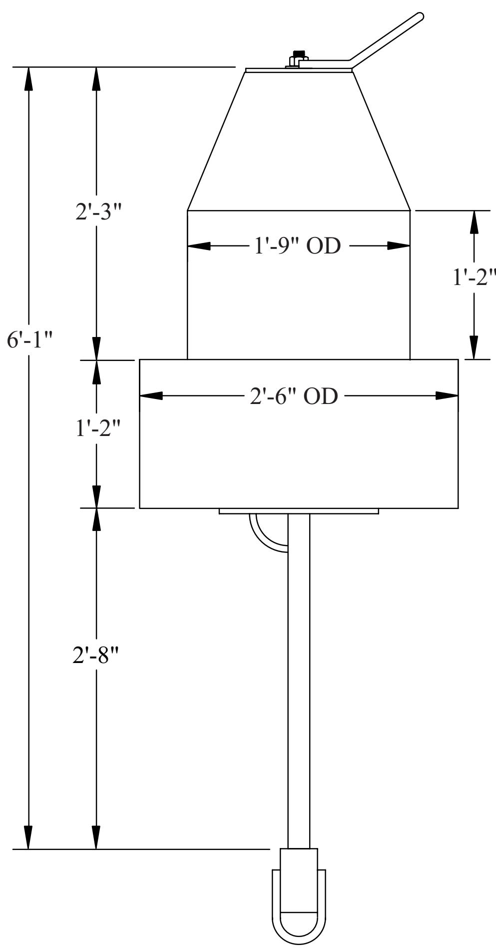
1989 TYPE
5CFR
BUOY WEIGHT: 147 lbs
DRAWING NO.: 121125

1995 TYPE
5CFR
BUOY WEIGHT: 115 lbs
DRAWING NO.: 121169

Data Sheet 2.K.37. (cont'd).

2.K. 38. 5NFR. The 5NFR is designed and constructed for protected locations where unlighted lateral buoys are required. This buoy is constructed of concentrically-wrapped sheets of ionomer foam with a "densified" outer surface for abrasion resistance. The structural members are galvanized steel. The radar reflector is internal. This buoy is not suitable for use where ice is present. The lifting eye plate is designed to accommodate the self-contained LED lantern described in Chapter 6 of this manual. In this configuration, the 5NFR can be deployed as a lighted discrepancy buoy. This buoy/lantern combination is the authorized replacement for the plastic discrepancy buoy shown on Data Sheet 2.K.45.

a. Standard Buoy Arrangement. 1995 Type 5NFR.



Physical Characteristics. (no mooring)

Buoy Weight	115 lbs.
Buoy Draft	3 ft. 0 in.
Freeboard	10 in.
Minimum Freeboard	4 in.
Pounds-Per-Inch Immersion	26

Related Equipment.

Mooring Chain	1/2 in.
Sinker (concrete)	500 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1.2 nm
Radar Range	0.5 nm
Mooring Depth (min.)	6 ft.

Maximum Mooring Depth.

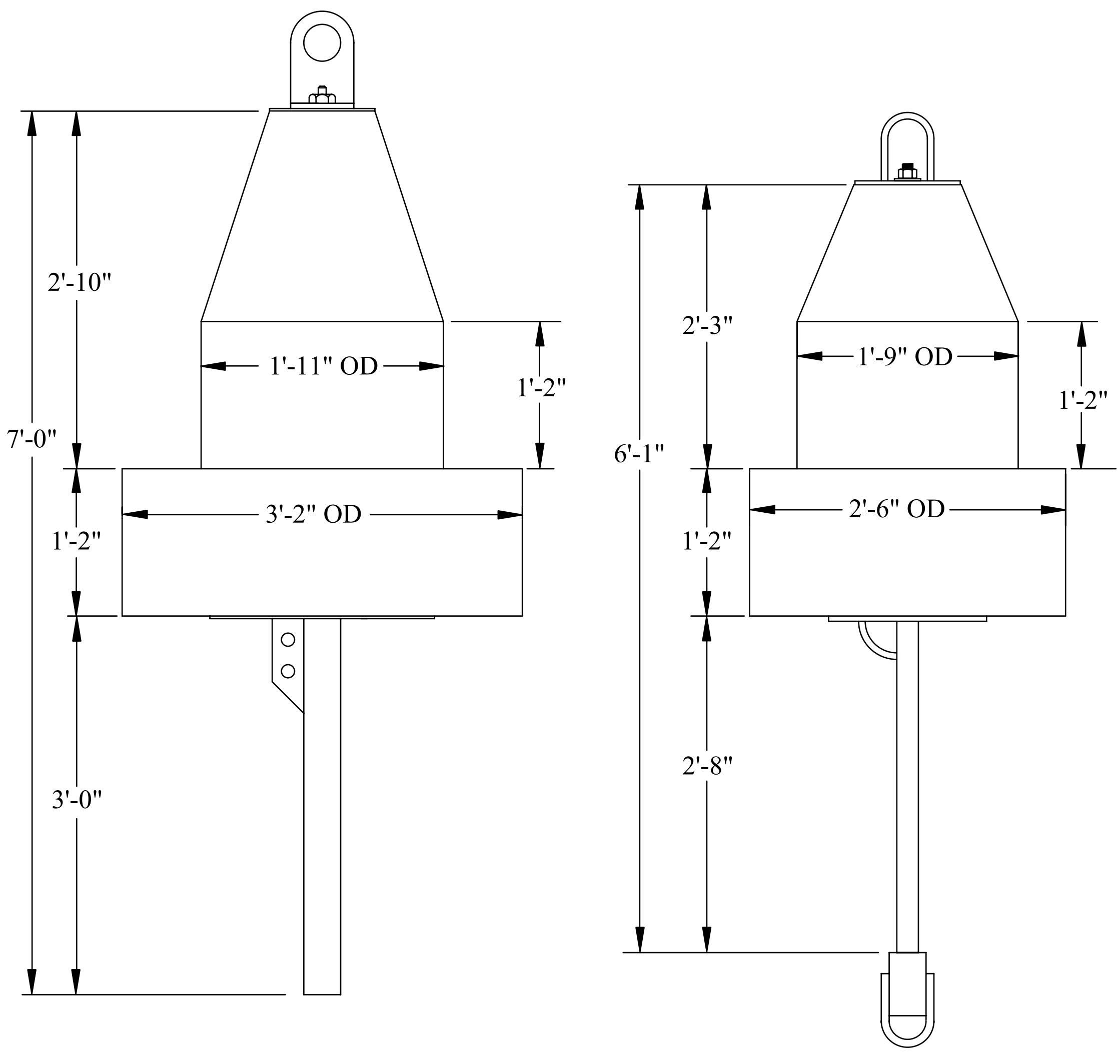
Chain Size	Max Mooring Depth
1/2"	40'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121169
G-SEC Specification No. 450

Assembly Instructions.
1. See general assembly guidelines in paragraph 2.F.1.
2. Slide the foam flotation collar and then the foam daymark (retro up) onto the center pipe.
3. Push the lifting eye plate firmly against the daymark. Bolt the lifting eye plate to the top of the center pipe. Place a washer between the lock nut and the lifting eye plate.

Data Sheet 2.K.38. 5NFR Buoy.

2.K.38. b. Non-Standard Buoy.



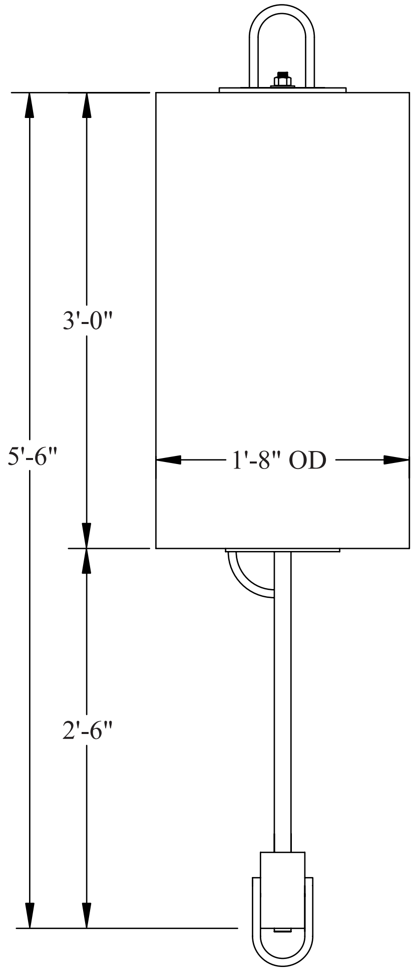
1989 TYPE
5NFR
BUOY WEIGHT: 147 lbs
DRAWING NO.: 121125

1995 TYPE
5NFR
BUOY WEIGHT: 115 lbs
DRAWING NO.: 121169

Data Sheet 2.K.38. (cont'd).

2.K. 39. 6CFR. The 6CFR is designed and constructed for the most protected locations where unlighted lateral buoys are required. This buoy is constructed of concentrically-wrapped sheets of ionomer foam with a "densified" outer surface for abrasion resistance. The structural members are galvanized steel. The radar reflector is internal. This buoy is not suitable for use where ice is present.

a. Standard Buoy Arrangement. 1995 Type 6CFR.



Physical Characteristics. (no mooring)

Buoy Weight	65 lbs.
Buoy Draft	3 ft.
Freeboard	2 ft. 6 in.
Minimum Freeboard	1 ft. 4 in.
Pounds-Per-Inch Immersion	12

Related Equipment.

Mooring Chain	1/2 in.
Sinker (concrete)	500 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1.0 nm
Radar Range	0.4 nm
Mooring Depth (min.)	6 ft.

Maximum Mooring Depth.

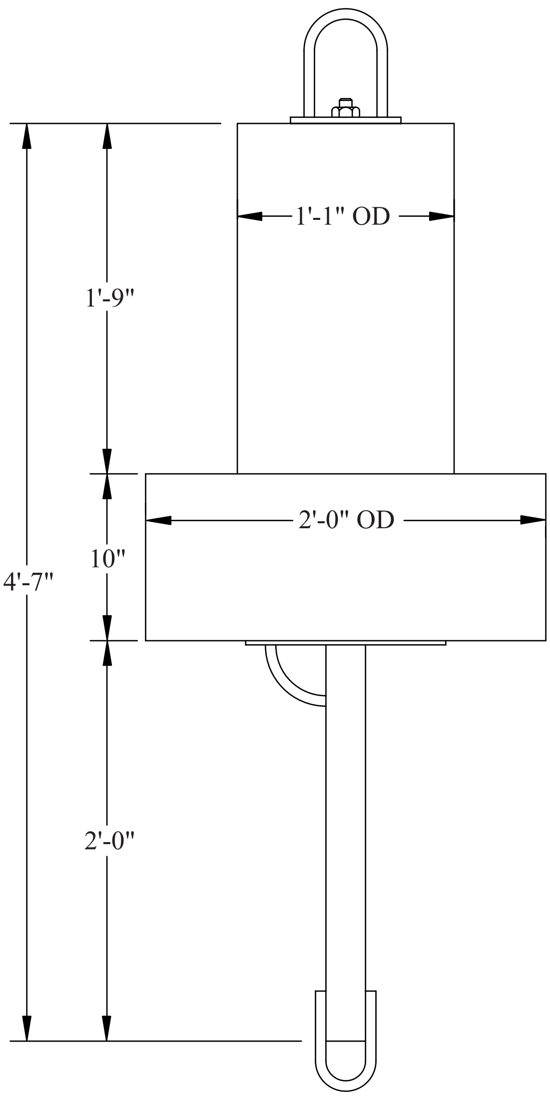
Chain Size	Max Mooring Depth
1/2"	21'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121171
G-SEC Specification No. 450

Assembly Instructions.
1. See general assembly guidelines in paragraph 2.F.1.
2. Slide the foam daymark (retro up) onto the center pipe.
3. Push the lifting eye plate firmly against the daymark. Bolt the lifting eye plate to the top of the center pipe. Place a washer between the lock nut and the lifting eye plate.

Data Sheet 2.K.39. 6CFR Buoy.

2.K.39. b. Non-Standard Buoy.

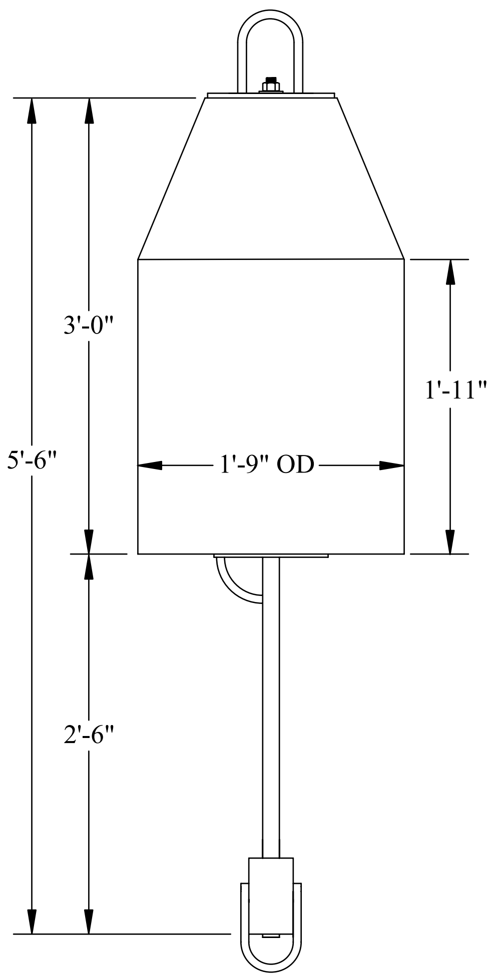


1989 TYPE
6CFR
BUOY WEIGHT: 40 lbs
DRAWING NO.: 121126

Data Sheet 2.K.39. (cont'd).

2.K. 40. 6NFR. The 6NFR is designed and constructed for the most protected locations where unlighted lateral buoys are required. This buoy is constructed of concentrically-wrapped sheets of ionomer foam with a "densified" outer surface for abrasion resistance. The structural members are galvanized steel. The radar reflector is internal. This buoy is not suitable for use where ice is presen.

a. Standard Buoy Arrangement. 1995 Type 6NFR.



Physical Characteristics. (no mooring)

Buoy Weight	70 lbs.
Buoy Draft	3 ft.
Freeboard	2 ft. 6 in.
Minimum Freeboard	1 ft. 4 in.
Pounds-Per-Inch Immersion	12

Related Equipment.

Mooring Chain	1/2 in.
Sinker (concrete)	500 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1.0 nm
Radar Range	0.4 nm
Mooring Depth (min.)	6 ft.

Maximum Mooring Depth.

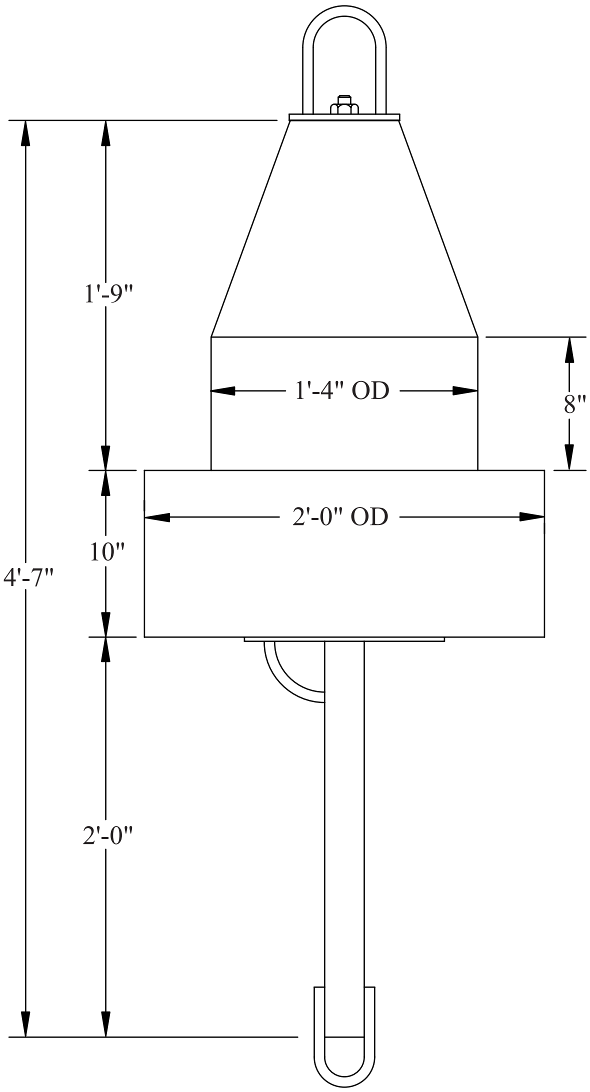
Chain Size	Max Mooring Depth
1/2"	21'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121171
G-SEC Specification No. 450

Assembly Instructions.
1. See general assembly guidelines in paragraph 2.F.1.
2. Slide the foam daymark (retro up) onto the center pipe.
3. Push the lifting eye plate firmly against the daymark. Bolt the lifting eye plate to the top of the center pipe. Place a washer between the lock nut and the lifting eye plate.

Data Sheet 2.K.40. 6NFR Buoy.

2.K.40. b. Non-Standard Buoy.

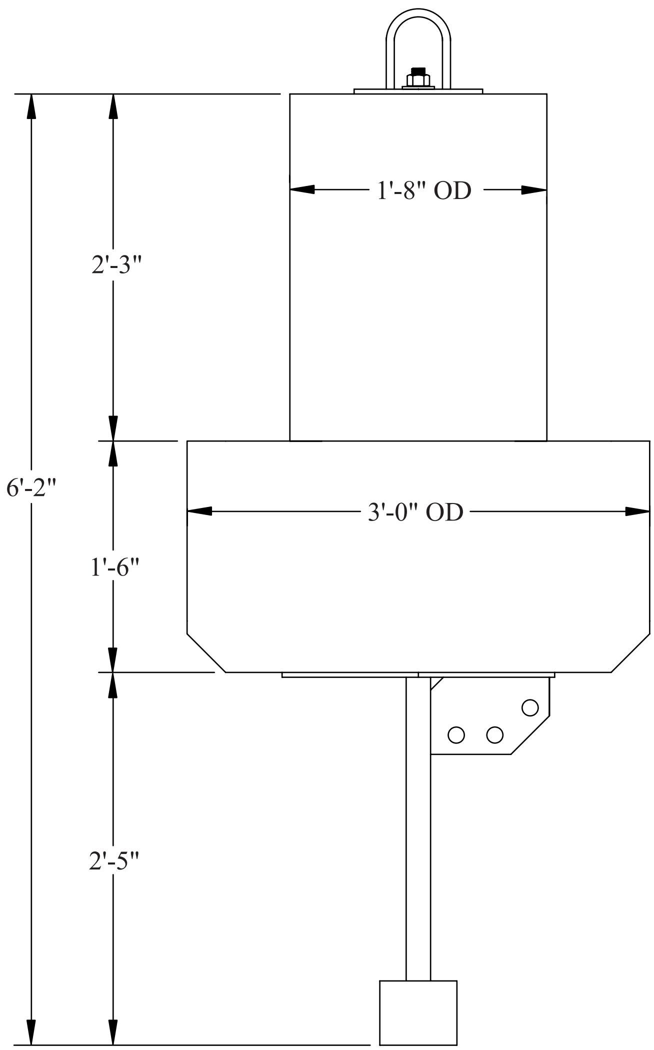


1989 TYPE
6NFR
BUOY WEIGHT: 40 lbs
DRAWING NO.: 121126

Data Sheet 2.K.40. (cont'd).

2.K. 41. FWCFR. The FWCFR buoy is designed and constructed for fast water locations where unlighted lateral buoys are required. This buoy is constructed of concentrically-wrapped sheets of ionomer foam with a "densified" outer surface for abrasion resistance. The structural members are galvanized steel. The radar reflector is internal. This buoy is not suitable for use where ice is present.

a. Standard Buoy Arrangement. 2002 Type FWCFR.



Physical Characteristics. (no mooring)

Buoy Weight	207 lbs.
Buoy Draft	1 ft. 1 in.
Freeboard	1 ft.
Minimum Freeboard	5 in.
Pounds-Per-Inch Immersion	38

Related Equipment.

Mooring Chain	1/2 in.
Wire Rope	1/2 in.
Sinker (concrete)	1000+ lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1 nm
Radar Range	0.5 nm
Mooring Depth (min.)	3 ft.

Maximum Mooring Depth.

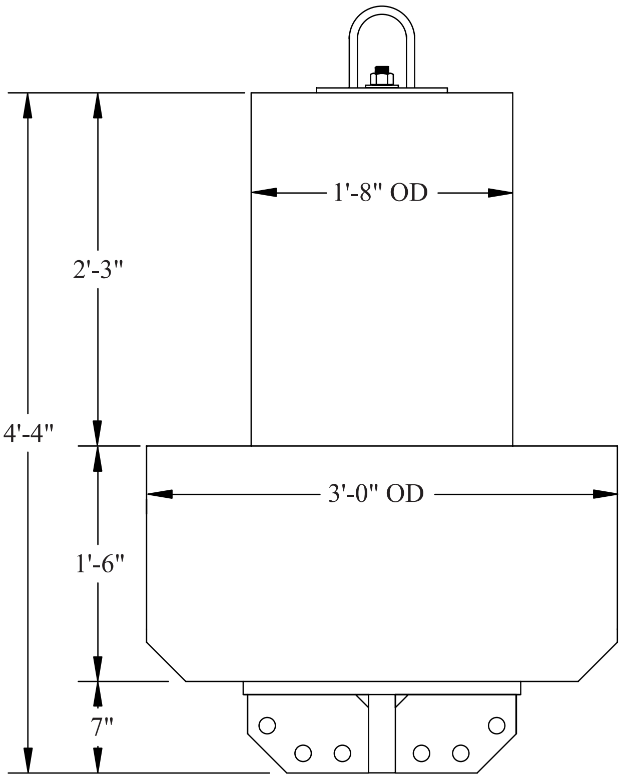
Chain Size	Max Mooring Depth
1/2"	71'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121170
G-SEC Specification No. 450

Assembly Instructions.
1. See general assembly guidelines in paragraph 2.F.1.
2. Slide the foam daymark (retro up) onto the center pipe.
3. Push the lifting eye plate firmly against the daymark. Bolt the lifting eye plate to the top of the center pipe. Place a washer between the lock nut and the lifting eye plate.

Data Sheet 2.K.41. FWCFR Fast Water Buoy.

2.K.41. b. Non-Standard Buoy.

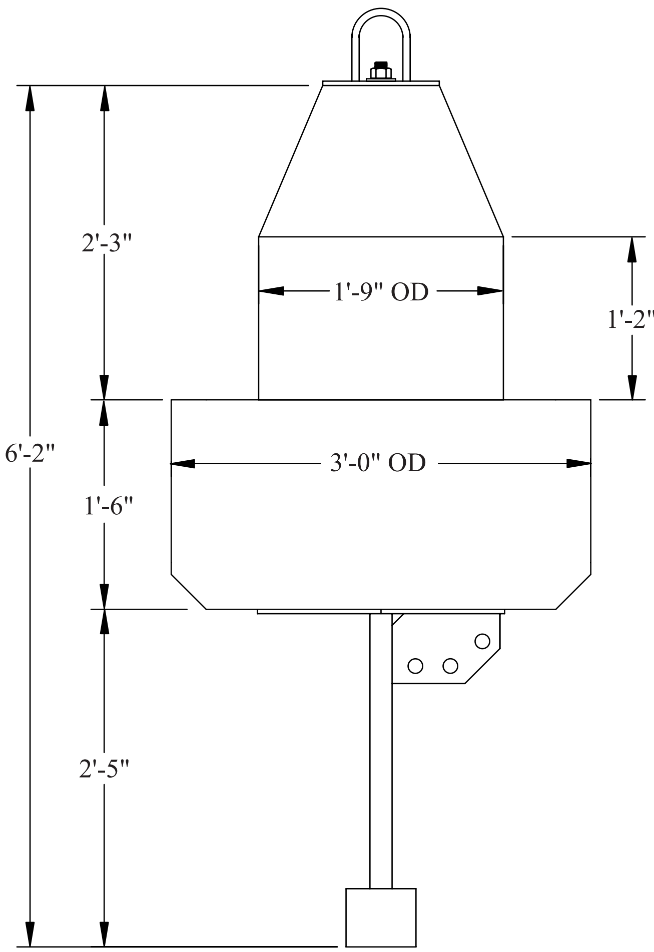


1995 TYPE
FWCFR
BUOY WEIGHT: 200 lbs.
DRAWING NO.: 121170

Data Sheet 2.K.41. (cont'd).

2.K. 42. FWNFR. The FWNFR buoy is designed and constructed for fast water locations where unlighted lateral buoys are required. This buoy is constructed of concentrically wrapped sheets of ionomer foam with a densified outer surface for abrasion resistance. The strength members are galvanized steel. The radar reflector is internal. This buoy is not suitable for use where ice is present.

a. Standard Buoy Arrangement. 2002 Type FWNFR.



Physical Characteristics. (no mooring)

Buoy Weight	203 lbs.
Buoy Draft	1 ft. 1 in.
Freeboard	1 ft.
Minimum Freeboard	5 in.
Pounds-Per-Inch Immersion	38

Related Equipment.

Mooring Chain	1/2 in.
Wire Rope	1/2 in.
Sinker (concrete)	1000+ lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1 nm
Radar Range	0.5 nm
Mooring Depth (min.)	3 ft.

Maximum Mooring Depth.

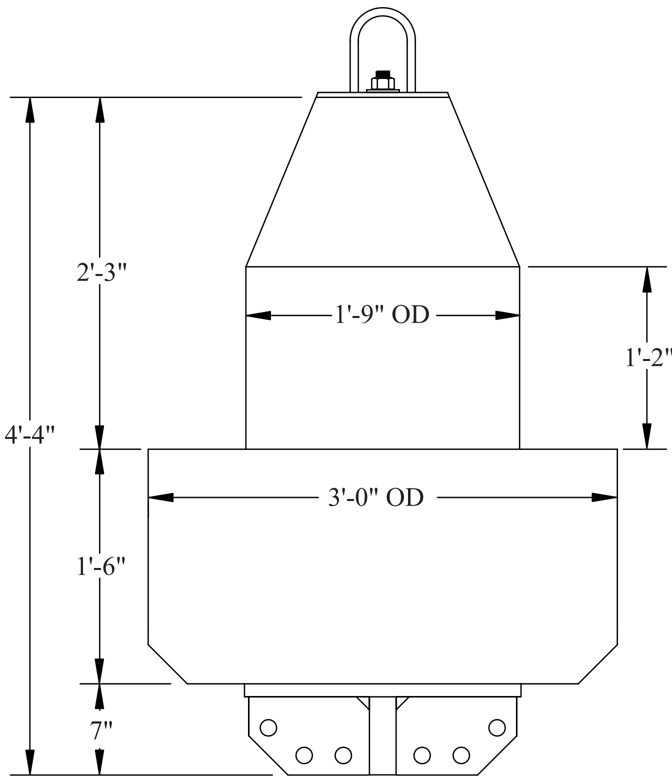
Chain Size	Max Mooring Depth
1/2"	71'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121170
G-SEC Specification No. 450

Assembly Instructions.
1. See general assembly guidelines in pragraph 2.F.1.
2. Slide the foam daymark (retro up) onto the center pipe.
3. Push the lifting eye plate firmly against the daymark. Bolt the lifting eye plate to the top of the center pipe. Place a washer between the lock nut and the lifting eye plate.

Data Sheet 2.K.42. FWNFR Fast Water Buoy.

2.K.42. b. Non-Standard Buoy.

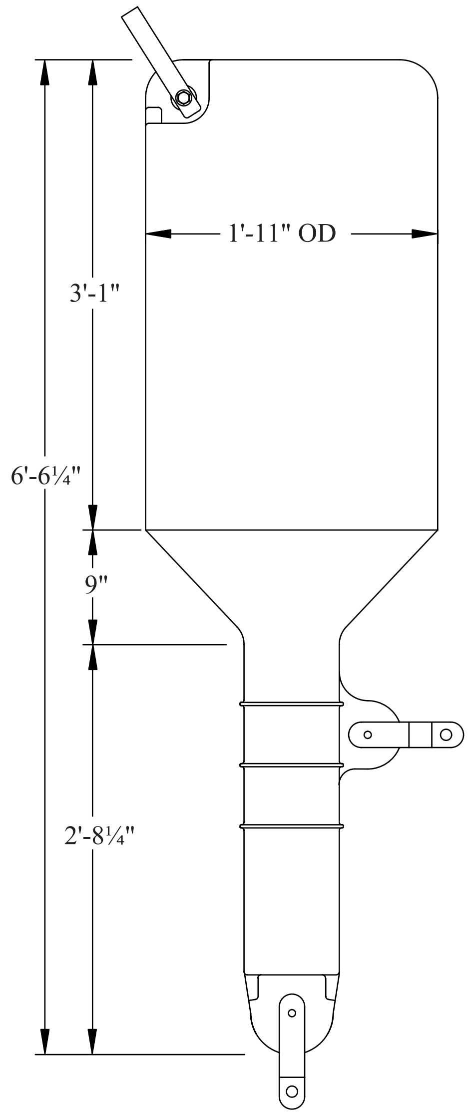


1995 TYPE
FWNFR
BUOY WEIGHT: 195 lbs.
DRAWING NO.: 121170

Data Sheet 2.K.42. (cont'd).

2.K. 43. 5CPR. The 5CPR is designed and constructed for use in protected locations where unlighted lateral buoys are required. A typical application would be as a temporary unlighted discrepancy buoy. This buoy is constructed of a hard shell plastic body filled with polyurethane foam. The mooring and lifting eyes are stainless steel. The radar reflector is internal. This buoy is not suitable for use where ice is present. It replaces the old style 5CPR and 6CPR buoys.

a. Standard Buoy Arrangement. 1996 Type 5CPR.



Physical Characteristics. (no mooring)

Buoy Weight	114 lbs.
Buoy Draft	3 ft 6 in.
Freeboard	3 ft.
Minimum Freeboard	2 ft. 1 in.
Pounds-Per-Inch Immersion	15

Related Equipment.

Mooring Chain	1/2 in.
Sinker (concrete)	500 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1 nm
Radar Range	0.5 nm
Mooring Depth (min.)	7 ft.

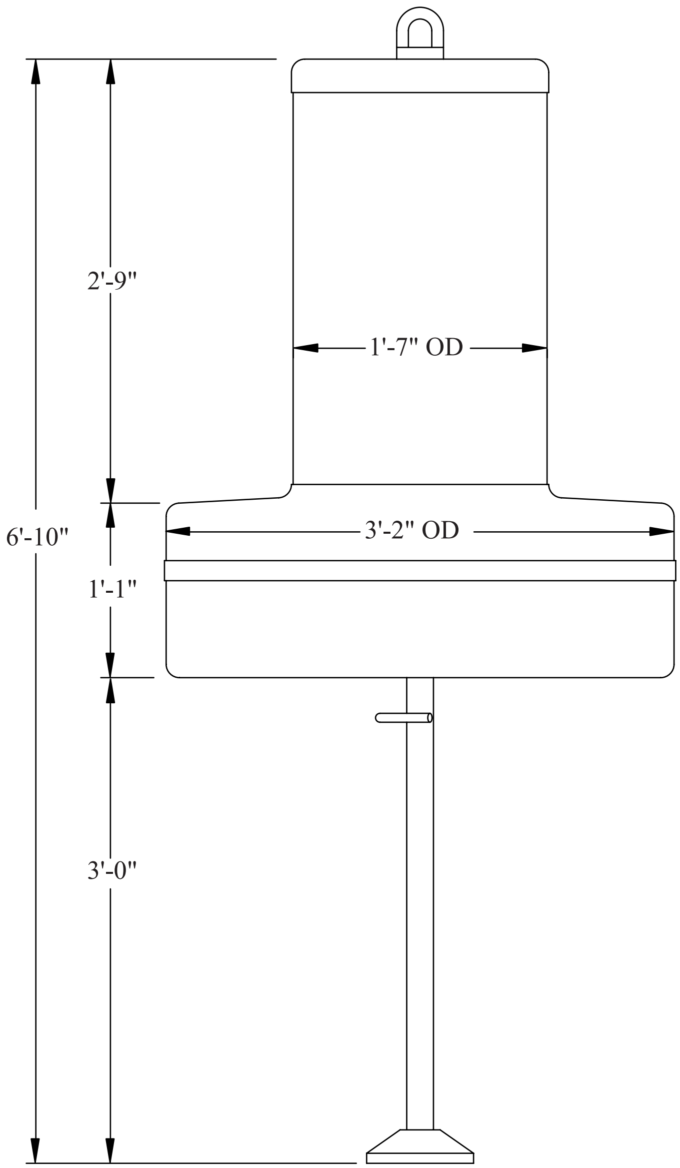
Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1/2"	35'

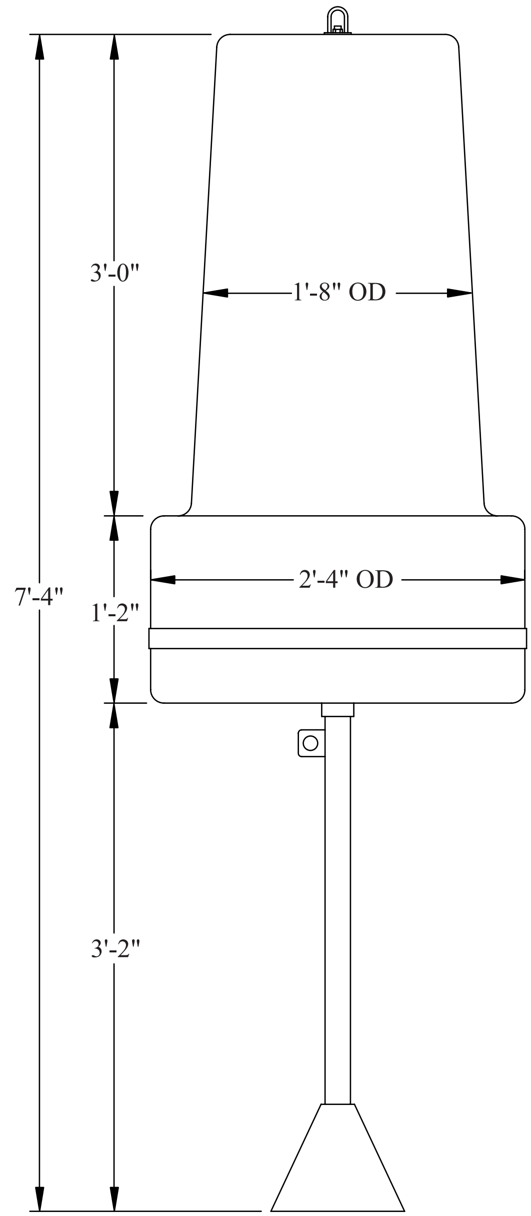
Reference Documents. (use latest rev.)
G-SEC Drawing No. 121172
G-SEC Specification No. 491

Data Sheet 2.K.43. 5CPR Buoy.

2.K.43. b. <u>Non-Standard Buoy (Old style 5CPR)</u>.



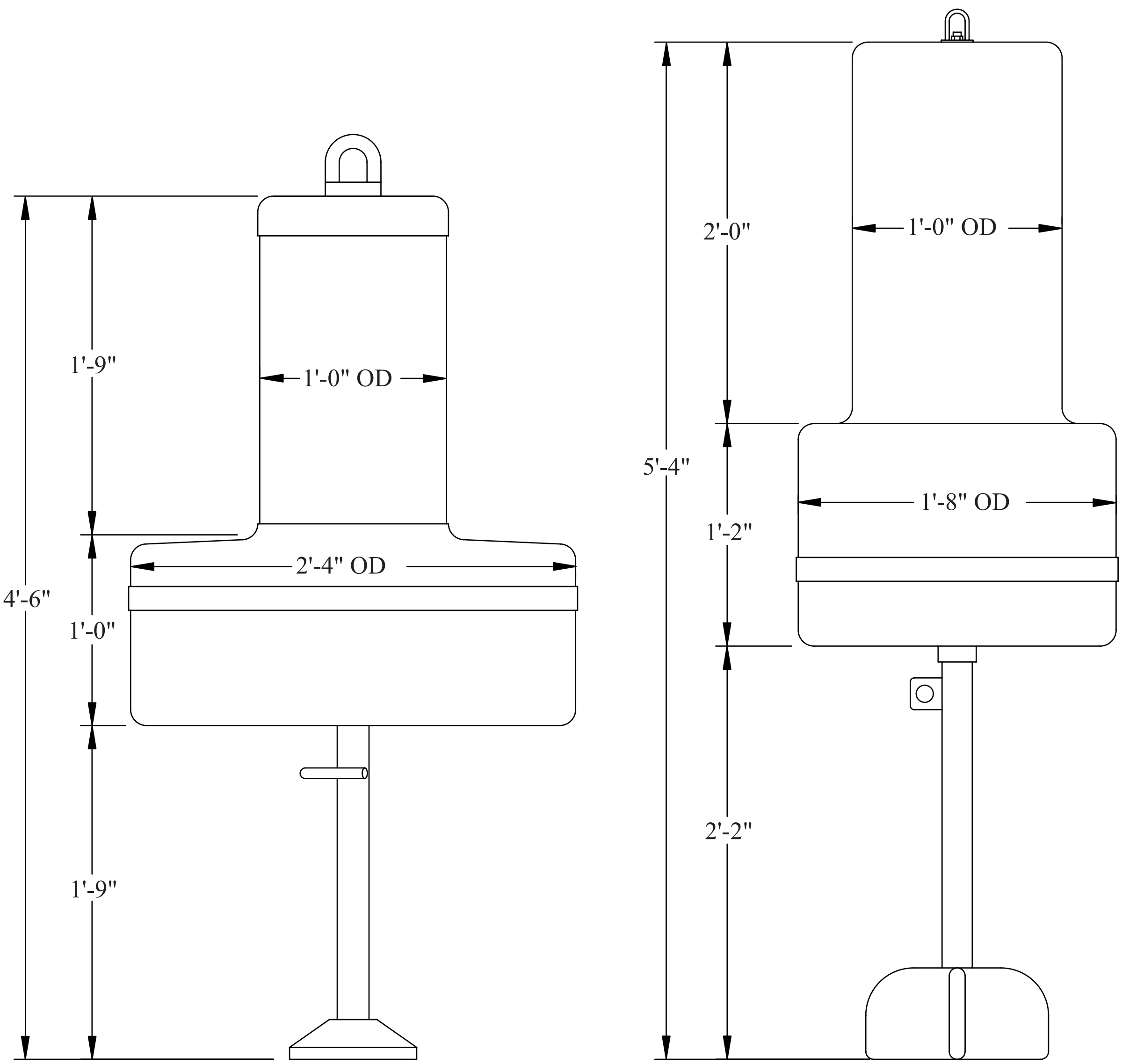
1972 ROLYAN TYPE
5CPR
WEIGHT: 121 LBS
DRAWING NO.: 120330



1973 AUTOMATIC POWER TYPE
5CPR
WEIGHT: 140 LBS
DRAWING NO.: 120334

Data Sheet 2.K.43. (cont'd).

2.K.43. c. Non-Standard Buoy (Old style 6CPR).



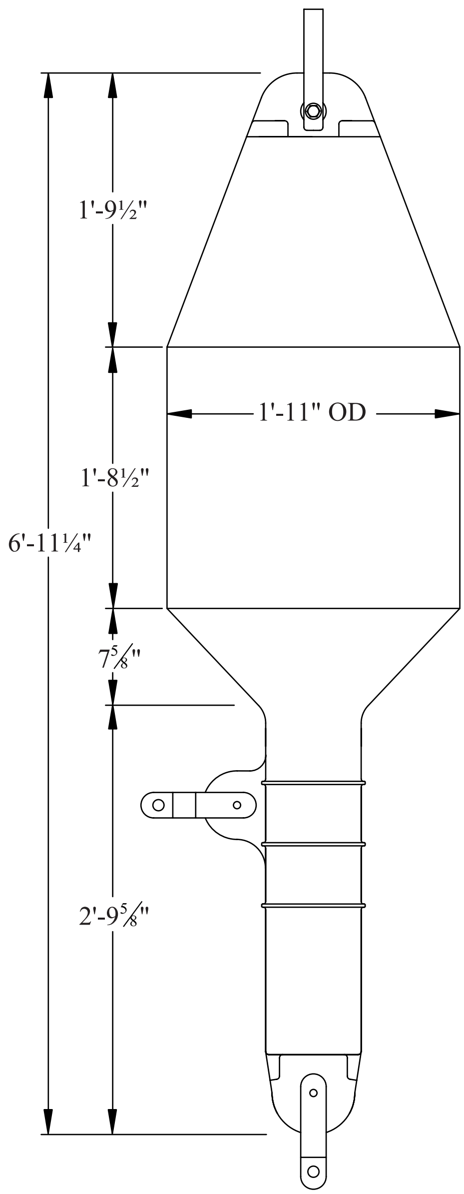
1972 ROLYAN TYPE
6CPR
WEIGHT: 58 LBS
DRAWING NO.: 120328

1973 AUTOMATIC POWER TYPE
6CPR
WEIGHT: 76 LBS
DRAWING NO.: 120332

Data Sheet 2.K.43. (cont'd).

2.K. 44. 5NPR. The 5NPR is designed and constructed for use in protected locations where unlighted lateral buoys are required. A typical application would be as a temporary unlighted discrepancy buoy. This buoy is constructed of a hard shell plastic body filled with polyurethane foam. The mooring and lifting eyes are stainless steel. The radar reflector is internal. This buoy is not suitable for use where ice is present. It replaces the old style 5NPR and 6CPR buoys.

a. Standard Buoy Arrangement. 1996 Type 5NPR.



Physical Characteristics. (no mooring)

Buoy Weight	114 lbs.
Buoy Draft	3 ft. 6 in.
Freeboard	3 ft.
Minimum Freeboard	2 ft. 1 in.
Pounds-Per-Inch Immersion	15

Related Equipment.

Mooring Chain	1/2 in.
Sinker (concrete)	500 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1 nm
Radar Range	0.5 nm
Mooring Depth (min.)	7 ft.

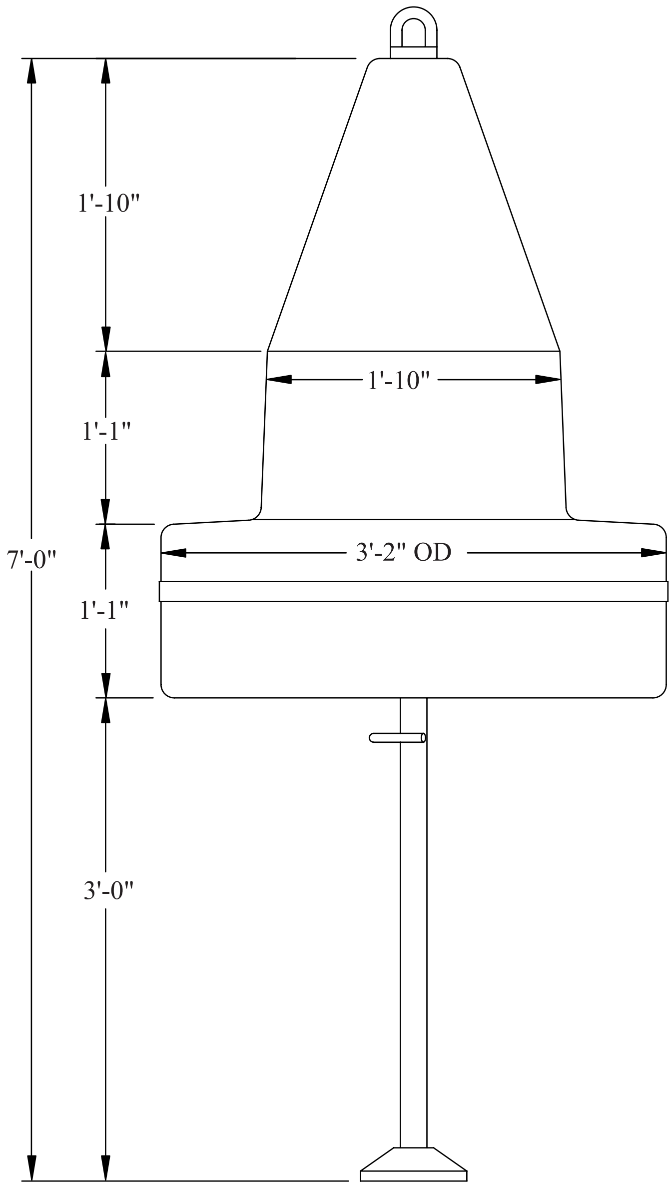
Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1/2"	35'

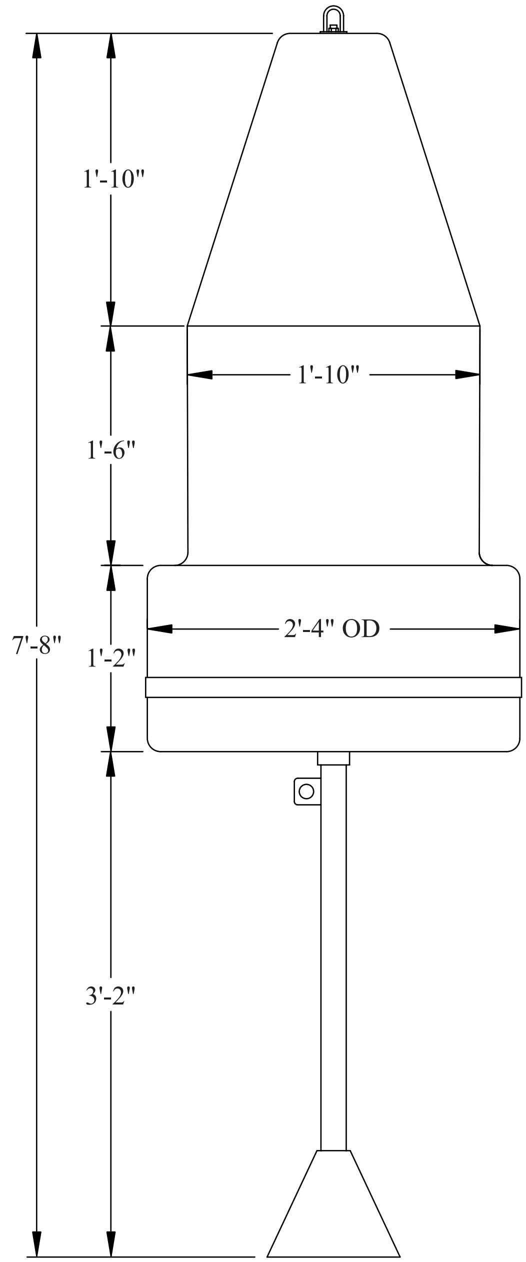
Reference Documents. (use latest rev.)
G-SEC Drawing No. 121173
G-SEC Specification No. 491

Data Sheet 2.K.44. 5NPR Buoy.

2.K.44. b. <u>Non-Standard Buoy (Old style 5NPR)</u>.



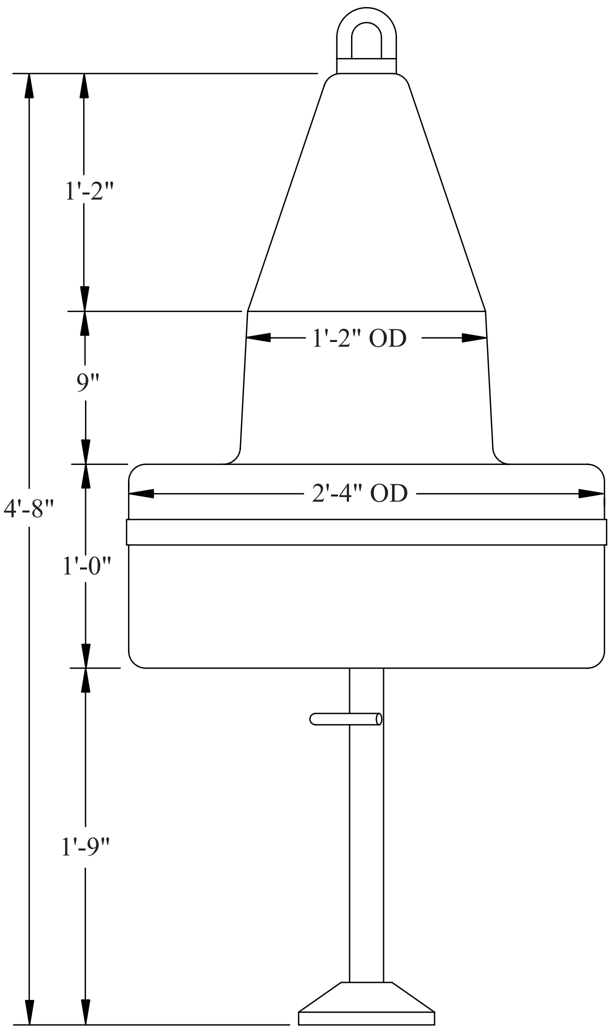
1972 ROLYAN TYPE
5NPR
WEIGHT: 121 LBS
DRAWING NO.: 120329

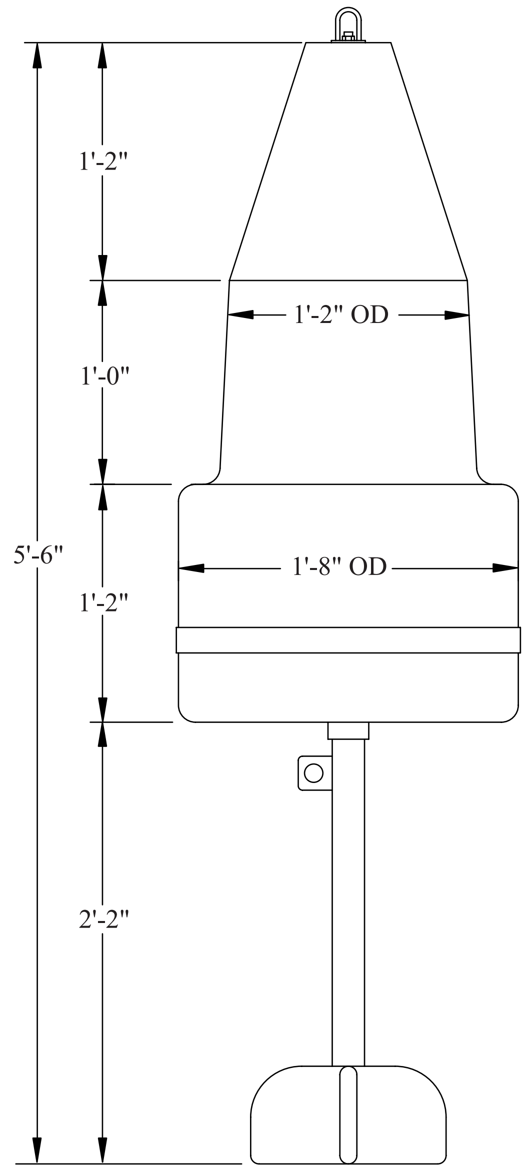


1973 AUTOMATIC POWER TYPE
5NPR
WEIGHT: 138 LBS
DRAWING NO.: 120333

Data Sheet 2.K.44. (cont'd).

2.K.44. c. <u>Non-Standard Buoy (Old style 6NPR)</u>.





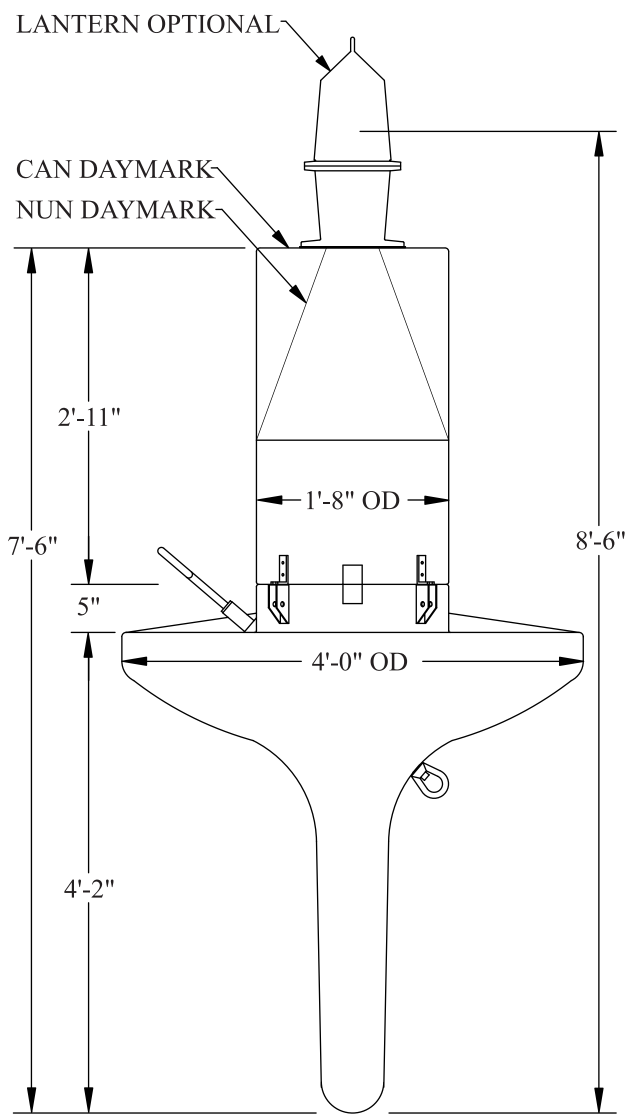
1972 ROLYAN TYPE
6NPR
WEIGHT: 59 LBS
DRAWING NO.: 120327

1973 AUTOMATIC POWER TYPE
6NPR
WEIGHT: 76 LBS
DRAWING NO. 120331

Data Sheet 2.K.44. (cont'd).

2.K. 45. Discrepancy Buoy. The discrepancy buoy is designed and constructed for temporary use in the most protected locations where lateral buoys are required. This buoy is constructed of a hard shell plastic body filled with polyurethane foam. The structural members are galvanized steel. The can and nun daymarks can be fitted with an internal radar reflector. A lantern and battery can be fitted to the daymark when lighted temporary marks are needed. This buoy is not suitable for use where ice is present. Although this buoy continues to be approved for use, the design has been discontinued and no new buoys will be manufactured. The authorized replacement is shown on Data Sheets 2.K.37 and 2.K.38.

a. Standard Buoy Arrangement. 1977 Type Discrepancy Buoy.



Physical Characteristics. (no mooring)

Buoy Weight	220 lbs.
Buoy Draft	4 ft.

Related Equipment.

Mooring Chain	3/8-1/2 in.
Sinker (concrete)	150-250 lbs.

Operational Characteristics. (nominal)

Daymark Visual Range	1 nm
Radar Range	1 nm
Mooring Depth (min.)	6 ft.
Mooring Depth (max. w/chain)	50 ft.

Reference Documents. (use latest rev.)

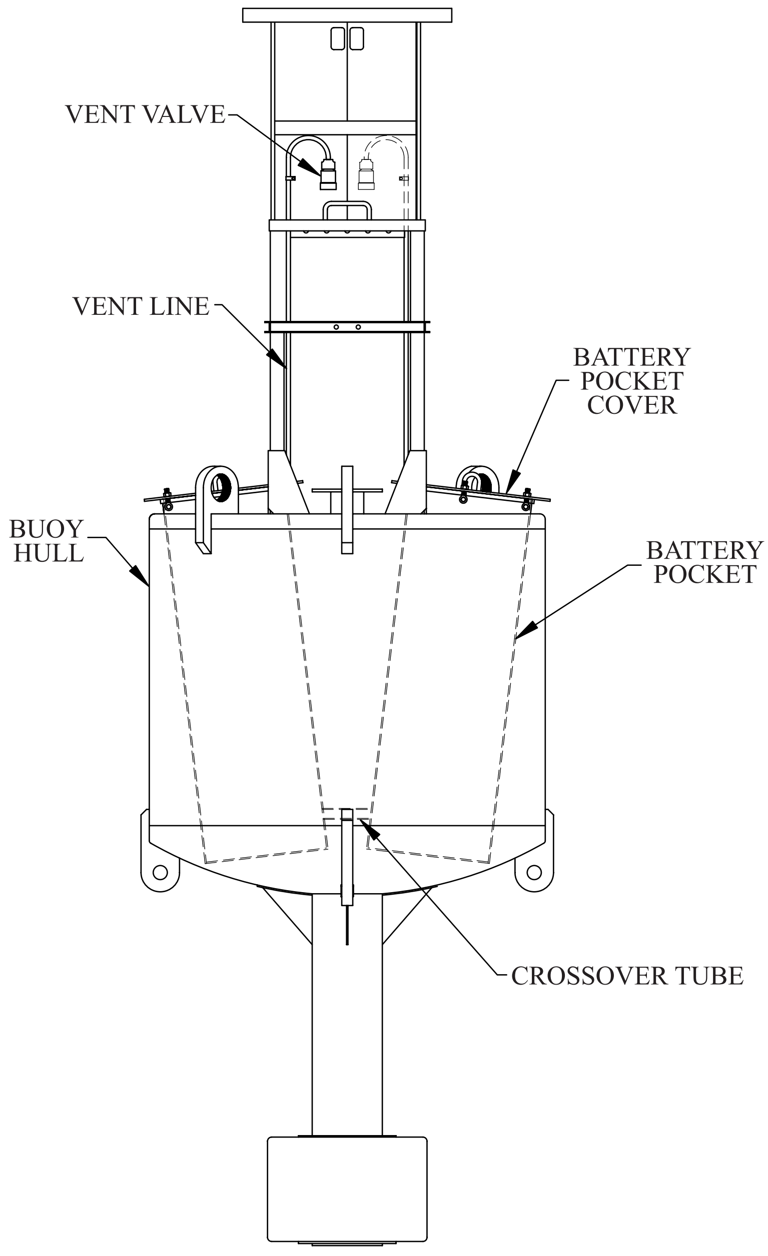
G-SEC Drawing No. 120768
G-SEC Specification No. 472
Stock Numbers:

Hull (gray)	NSN 2050-01-225-7276
Can Daymark	NSN 2050-01-222-3938
Nun Daymark	NSN 2050-01-224-6042
Radar Refelctor	NSN 2050-01-225-2779

Data Sheet 2.K.45. Discrepancy Buoy.

2.L. Buoy Outfitting Equipment. Buoy outfitting equipment is presented in this section. Buoy markings, light signals, electronic sound signals, and power systems are presented in later chapters of this manual.

2.L. 1. Vent Lines. The batteries used in lighted buoys require a continuous means of airflow. Air-depolarized primary batteries require air to produce energy while secondary (solar) batteries must be provided with a means to vent hydrogen gas. The airflow is provided through 3/4 inch Schedule 40 stainless steel vent lines. The standard two-pocket venting system is shown below. Remove vent lines if battery pockets are welded shut.



Vent line and crossover tube placement on a two-pocket buoy.

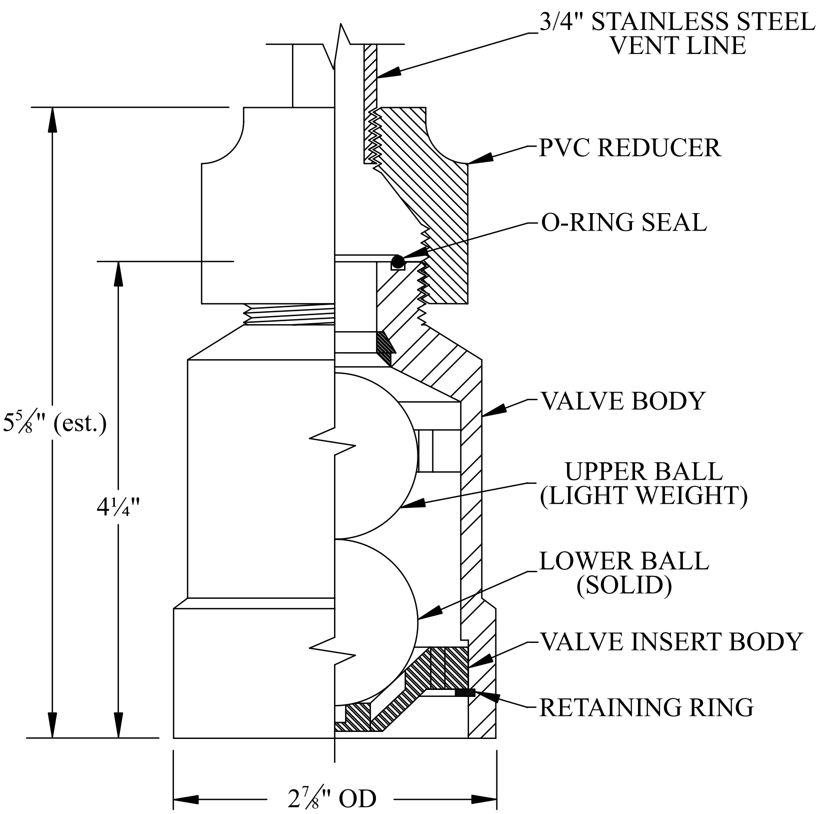
Data Sheet 2.L.1. Vent Lines.

2.L. 2. Vent Valves. Buoy vent valves are specialized versions of check valves. They are designed to seal the vent lines on lighted buoys if the buoy heels beyond 30 degrees or submerges. The PVC valve uses an o-ring to achieve a watertight seal with the PVC vent line reducer. All lighted buoys use vent valves. The standard arrangement is shown below.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 107334
G-SEC Specification No. 382

Stock Numbers:

Vent Valve Overhaul Kit	NSN 4820-01-106-5983
Vent Valve	NSN 4820-00-076-6748
PVC Reducer	NSN 4730-01-029-6548

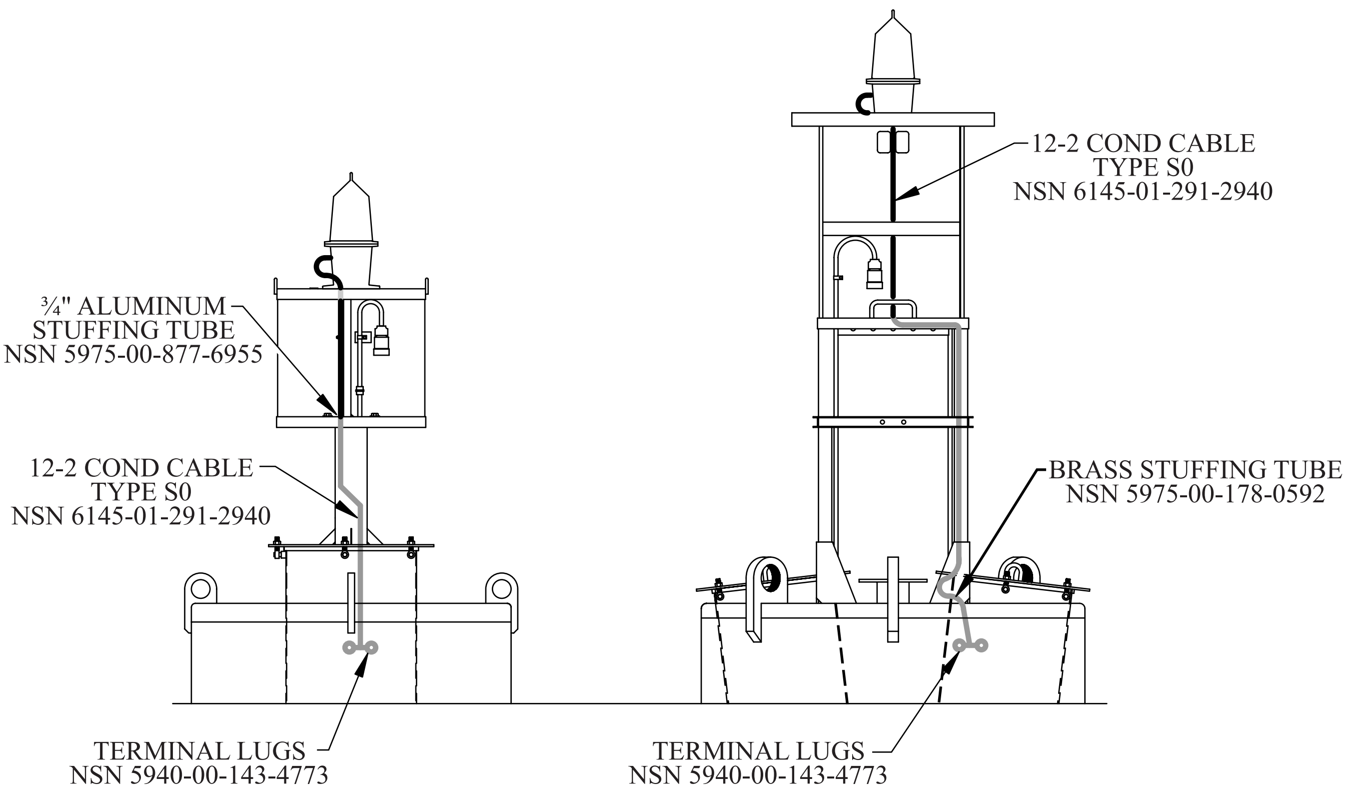


Data Sheet 2.L.2. Vent Valves.

2.L. 3. Wiring. The external wiring of the buoy is used to carry electrical current from the batteries to the lantern. Two-conductor type SO (12/2 or 10/2) is used (see chapter 6 of this manual). The length of cable varies according to the buoy type, power source, and wiring method. For reference purposes, the length of cable required to run from the battery pocket to the lantern is given below:

Buoy	Cable (ft.)
3.5X8	10
5X11	10
6X20	19
7X17	19
8X26	25
9X32	30

Wiring diagrams for various buoy configurations are shown below.

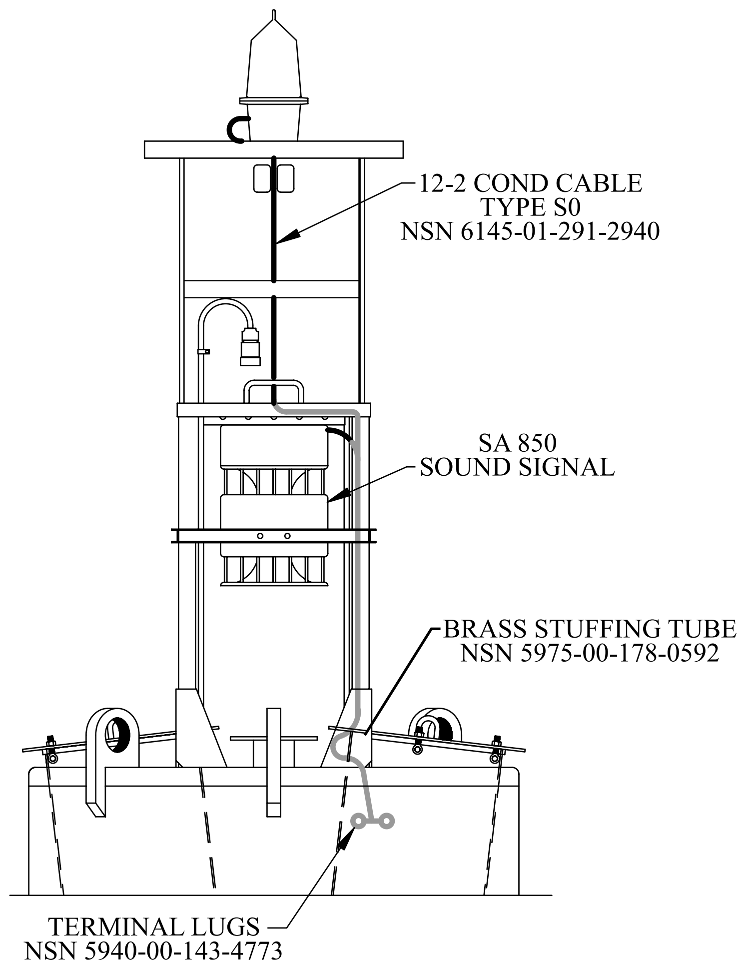


Wiring diagram for single pocket buoy.

Wiring diagram for two-pocket buoy with one power unit.

Data Sheet 2.L.3. Wiring.

2.L.3.



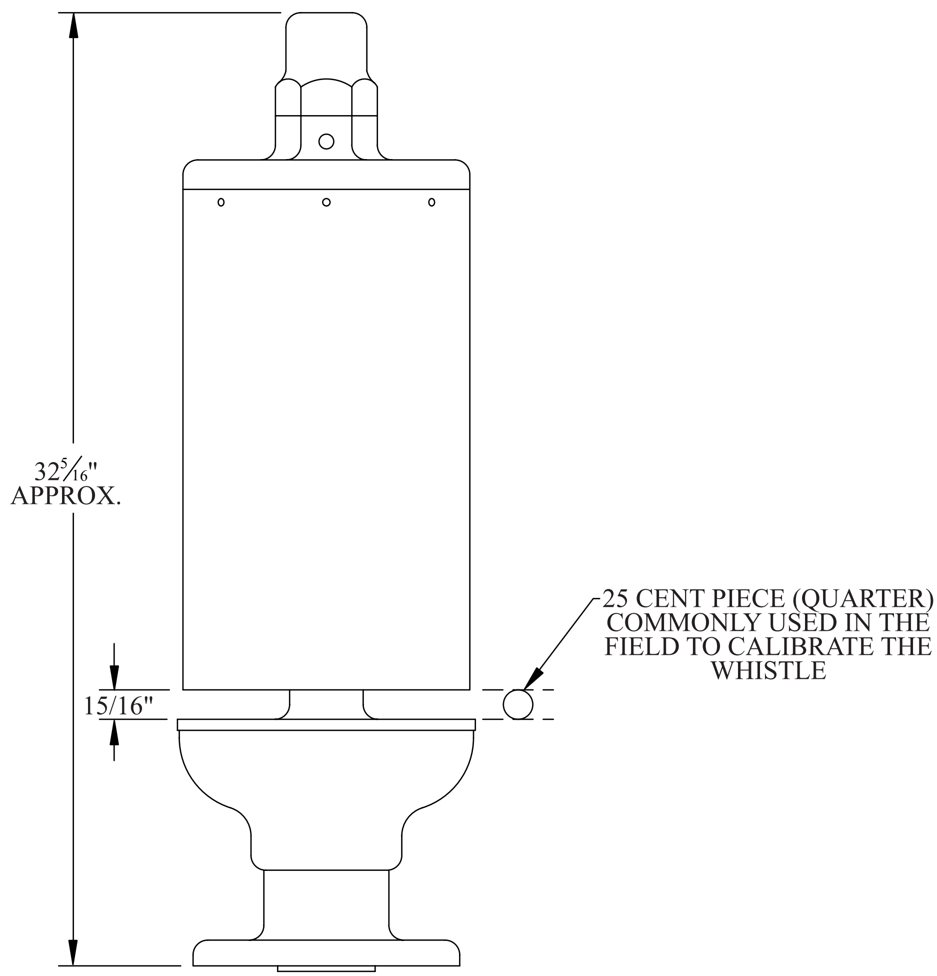
Wiring diagram for two-pocket buoy with electronic sound signal.

Data Sheet 2.L.3. (cont'd)

2.L. 4. Whistle. Whistles are made of a copper-silicon alloy. The air in the open counterweight tube of the buoy rises and falls with wave action. The downward motion of the buoy forces air through the whistle valve to the whistle. The escaping air causes the familiar drone. The standard arrangement is shown below.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 120777
G-SEC Specification No. 381
Weight: 155lbs

Stock Number: NSN 6350-01-034-1347



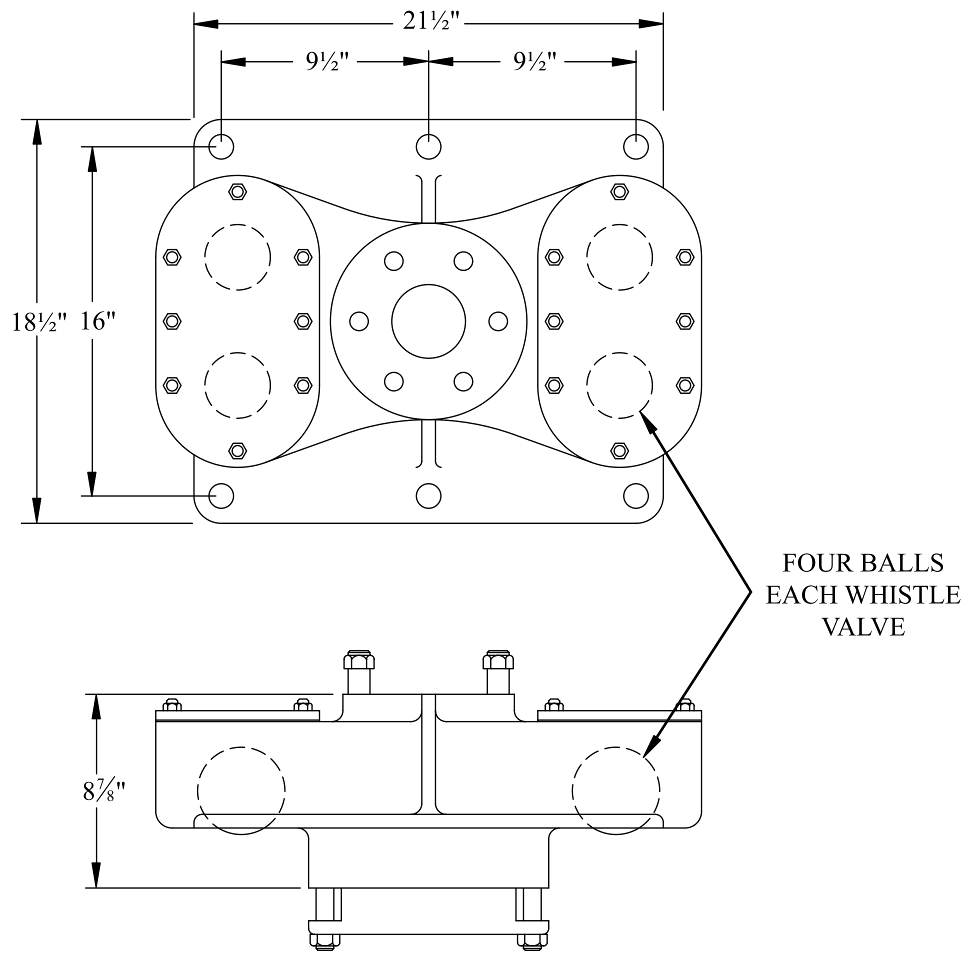
Data Sheet 2.L.4. Whistle.

2.L. 5. Whistle Valve. Whistle valves are made of a copper-silicon alloy. The valve balls are either cork or rubber. Air is forced up from the buoy counterweight tube during downward motion causing the balls to seal the air ports in the valve, thus forcing the air to flow into the whistle. Upward motion of the buoy causes a suction which lifts the balls, thus allowing air to be drawn back down the counterweight tube. The standard arrangement is shown below.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 120777
G-SEC Specification No. 381
Weight: 265 lbs

Stock Numbers:

Valve	NSN 4820-01-034-1348
Replacement Balls	NSN 2050-00-301-4067



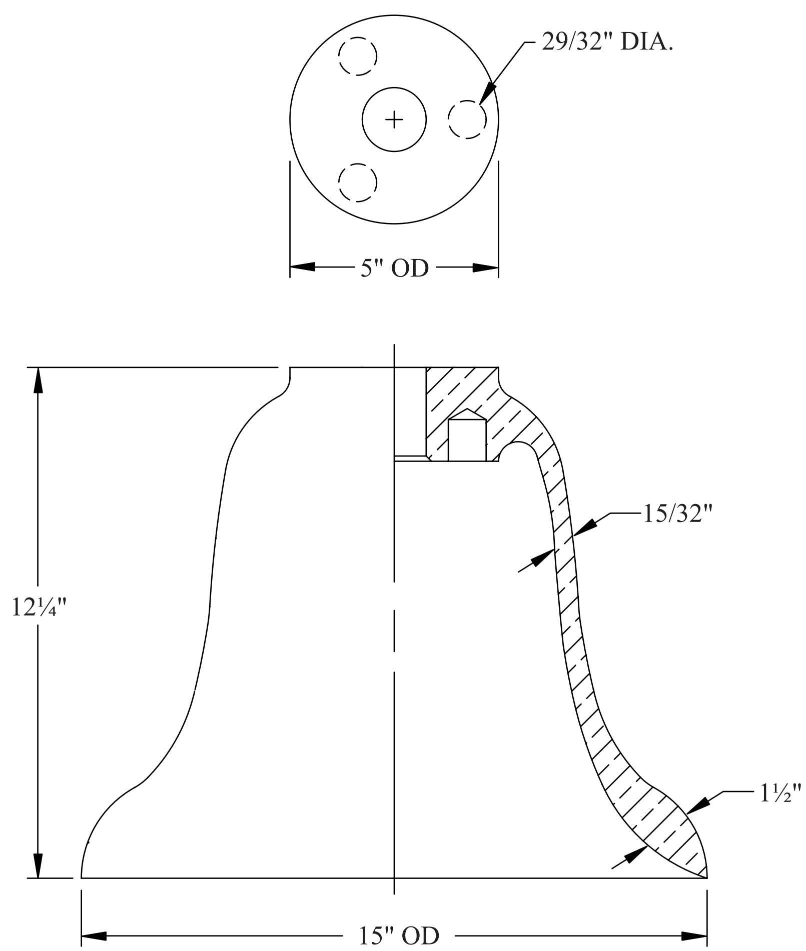
Data Sheet 2.L.5. Four-Ball Whistle Valve.

2.L. 6. Bells. The bells used on lighted and unlighted bell buoys are made of a copper-silicon alloy. External tappers impact the fixed bell when wave motion causes the buoy to roll. The standard bell configurations are shown below.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 120994
G-SEC Specification No. 357

Stock Numbers:

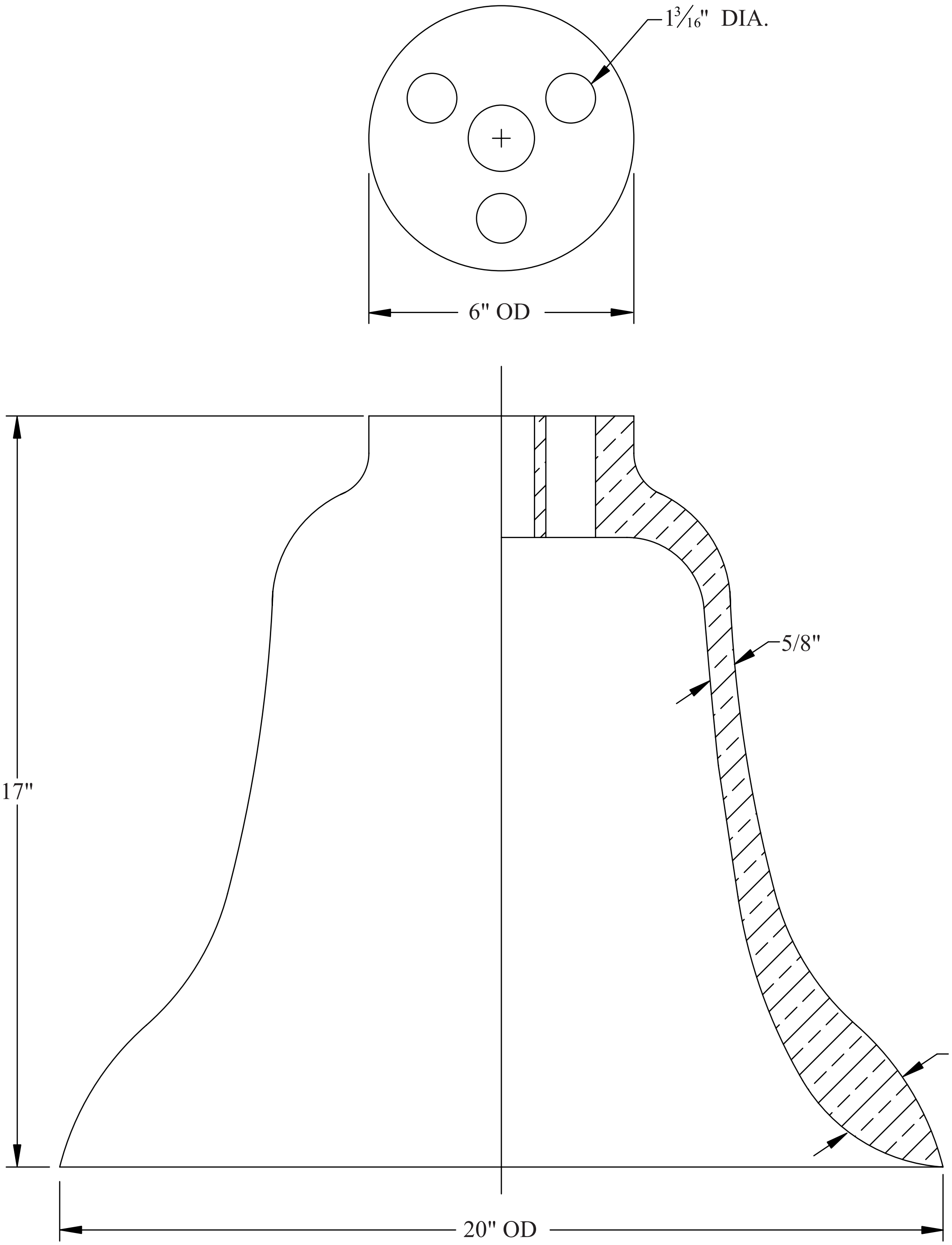
Bell, 85#	NSN 6450-01-034-1349
Bell, 225#	NSN 6450-01-034-1350



85 LB. Buoy Bell

Data Sheet 2.L.6. Bells.

2.L.6.



225 LB. Buoy Bell

Data Sheet 2.L.6. (cont'd).

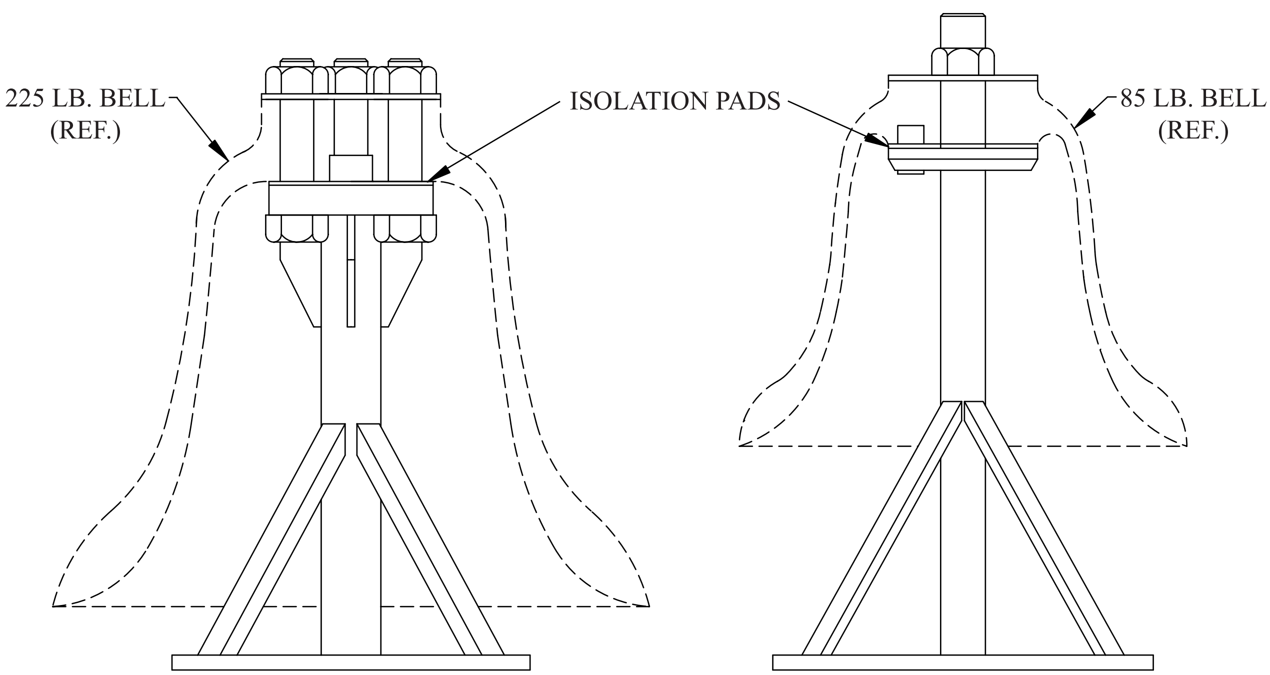
2.L. 7. Bell Stands. The bells used on lighted and unlighted bell buoys are mounted on steel stands which are bolted to the bell/gong mounting flange. Isolation pads (1/8 inch thick rubber) are placed between the bell stand and the bell to prevent vibrations from being transmitted to the buoy and to lessen the shock on the stand. An additional pad is often used between the stand and the buoy flange. Stainless steel mounting hardware is provided with each stand. Bell stands are delivered with a primer coat only.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 120998
G-SEC Specification No. 362

Weight:
85# Bell Stand: 78 lbs
225# Bell Stand: 105 lbs

Stock Numbers:

Bell Stand, 85#	NSN 2050-00-856-4618
Bell Stand, 225#	NSN 2050-00-856-4614



225 LB.
Bell Stand

85 LB.
Bell Stand

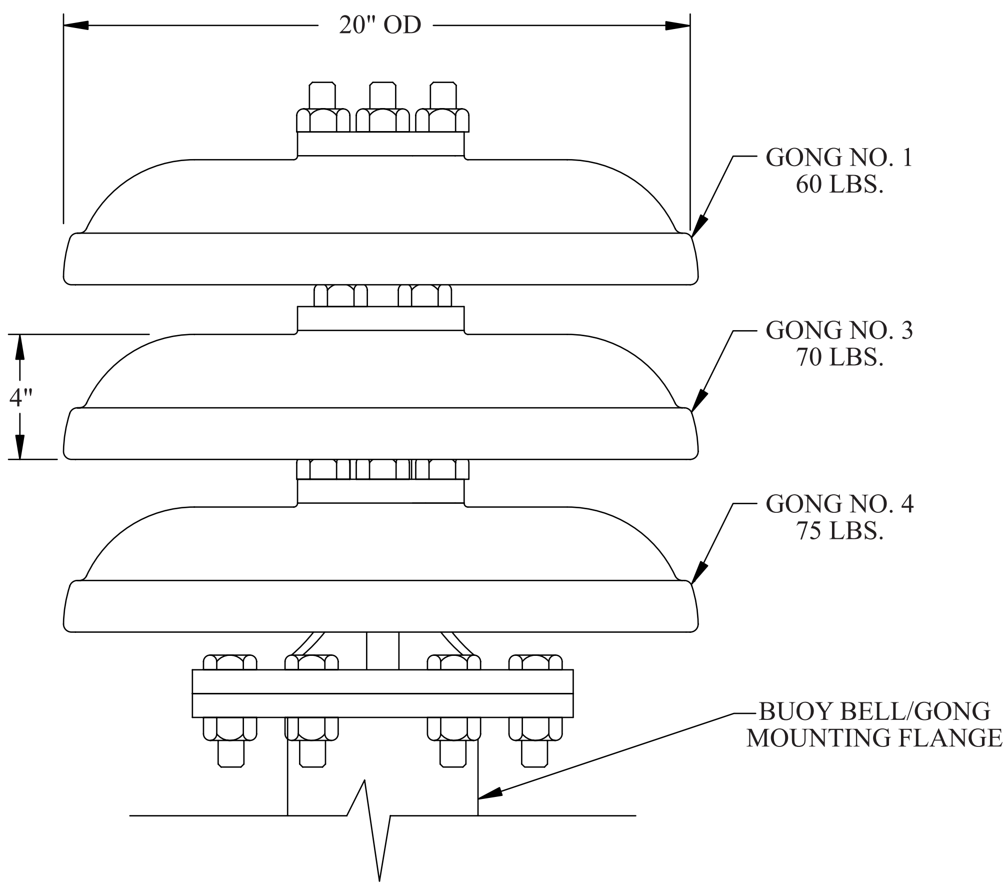
Data Sheet 2.L.7. Bell Stands.

2.L. 8. Gongs. The gongs used on lighted and unlighted gong buoys are made of a copper-silicon alloy. External tappers impact the fixed gongs when wave motion causes the buoy to roll. Each gong emits a different tone when struck with the tapper, thus distinguishing the signal from that of a bell. The standard gong configuration is shown below.

Reference Documents. (use latest rev.)
G-SEC Drawings No. 120994
G-SEC Specification No. 357

Stock Numbers:

Gong #1, 20"	NSN 6350-01-034-1352
Gong #3, 20"	NSN 6350-01-034-1354
Gong #4, 20"	NSN 6350-01-034-1353



Weight (including stand): 371 lbs

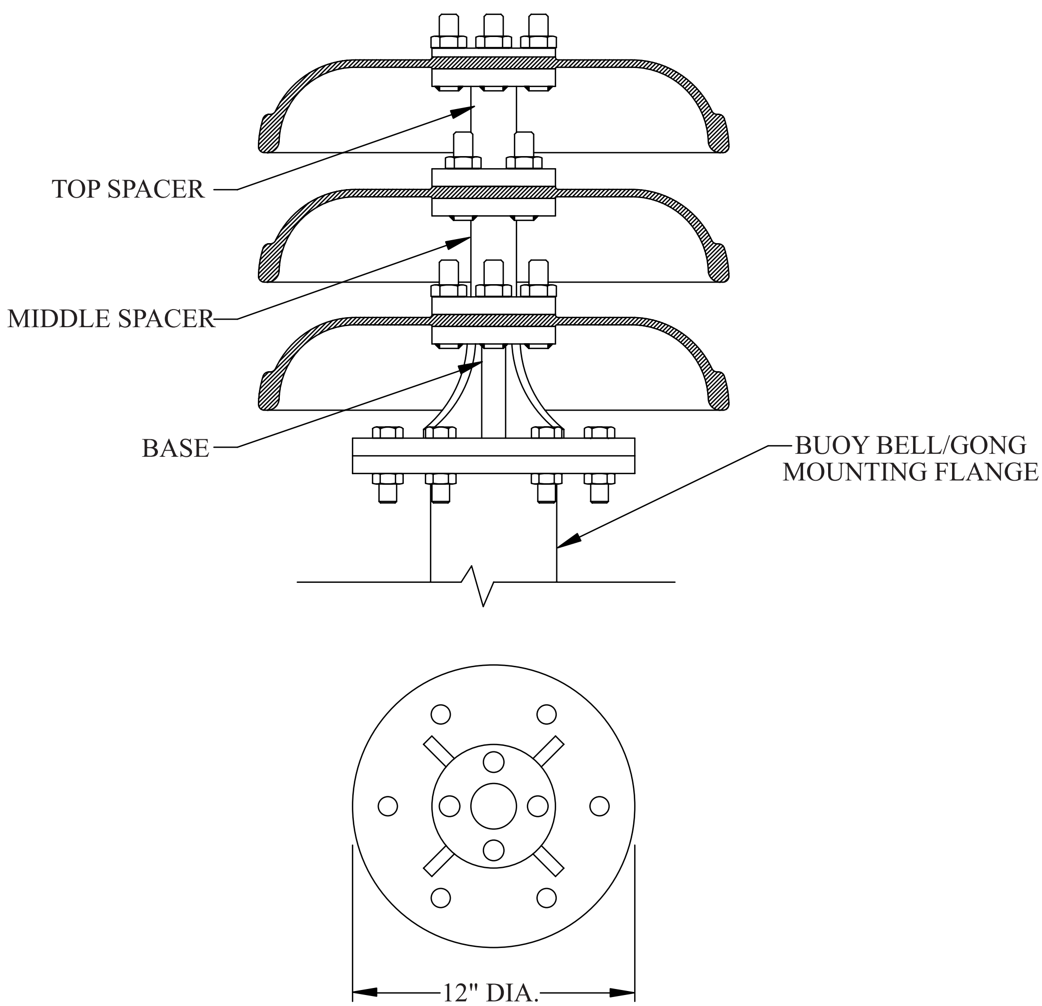
Data Sheet 2.L.8. Gongs.

2.L. 9. Gong Stands. The gongs used on lighted and unlighted gong buoys are mounted on steel stands which are bolted to the bell/gong mounting flange. Stainless steel mounting hardware is provided with each stand. Gong stands are delivered with a primer coat only. The gong stands are shown below.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 120998
G-SEC Specification No. 362

Stock Numbers:

Gong Stand	NSN 2050-00-301-4074



20" Gong Assembly

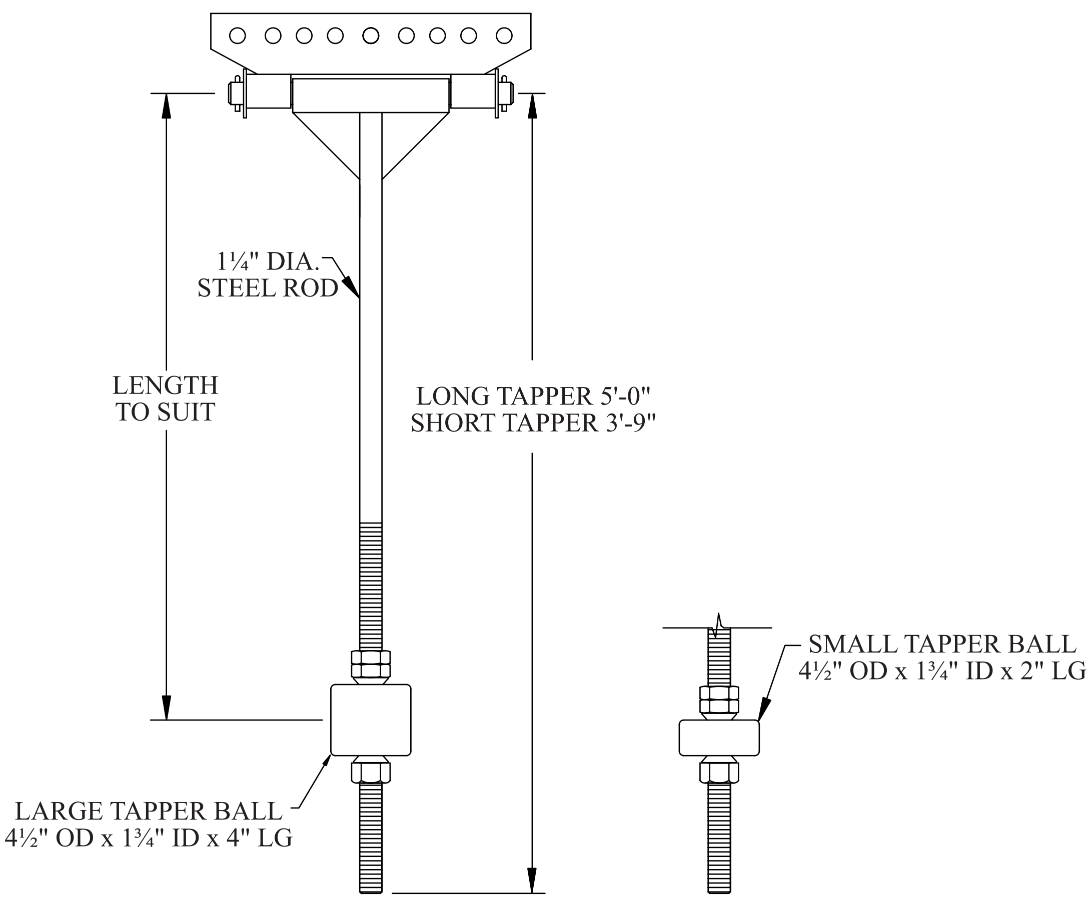
Data Sheet 2.L.9. Gong Stands.

2.L. 10. Tappers. Tappers are used to strike wave-actuated sound signals. They swing on hinges and strike a bell or gong with a cylindrical ball to make a characteristic tone. Stainless steel hardware is provided with each tapper assembly. Tapper assemblies are delivered with a primer coat only. Replacement tapper balls may be ordered. The standard tapper configuration is shown below.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121159
G-SEC Specification No. 360

Stock Numbers:

Long Tapper Assembly (Large Ball)	NSN 2050-01-025-3527
Short Tapper Assembly (Large Ball)	NSN 2050-01-025-3526
Short Tapper Assembly (Small Ball)	NSN 2050-01-019-0107
Large Balls	NSN 2050-01-392-0939
Small Balls	NSN 2050-01-391-6302



Data Sheet 2.L.10. Tappers.

STANDARD TAPPERS FOR VARIOUS BUOY SIZES		
BUOY CLASS	**BELL**	**GONG**
9X32	4 LONG	1 SHORT (LG Ball), 2 LONG
9X20	4 LONG	2 SHORT (LG Ball), 1 LONG
8X26	4 LONG	2 SHORT (LG Ball), 1 LONG
8X21	4 LONG	2 SHORT (LG Ball), 1 LONG
7X17	4 SHORT(Small Ball)	N/A
6X20	4 SHORT(Small Ball)	N/A

Data Sheet 2.L.10. (cont'd).

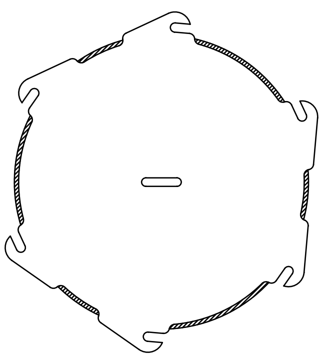
2.L. 11. 24" Pocket Closures. Pocket closures are designed to ensure watertight integrity of the battery pockets on lighted buoys. The 24 inch pocket closure is used on 8X26, 8X21, 9X32, and 9X35 buoys. The standard 24 inch closure uses a swingbolt mount (welded to the buoy pocket), a flat neoprene gasket, a flat cover, and 6 stainless steel swingbolts. Pocket covers are delivered with a primer coat only. They shall be color coated to match the buoy.

a. Standard Arrangement. 24" Swingbolt Closure.

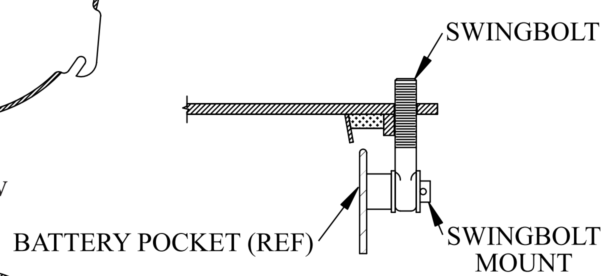
Reference Documents. (use latest rev.)
G-SEC Drawing No. 121143
G-SEC Specification No. 484

Stock Numbers:

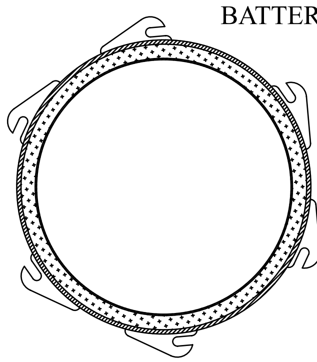
24" Cover	NSN 6160-01-386-9957
Gasket (Roll)	NSN 5330-00-542-1984
Swingbolt & Nut (1)	NSN 5340-01-034-5222
Swingbolt Mount (6)	NSN 5315-01-288-0729



Top View



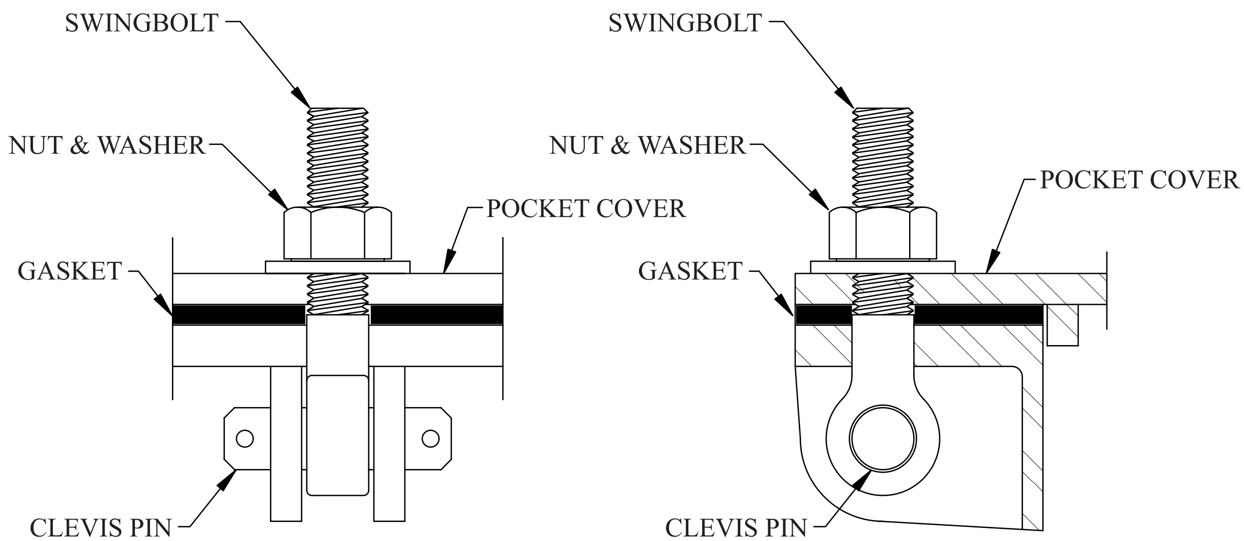
Cross Sectional View



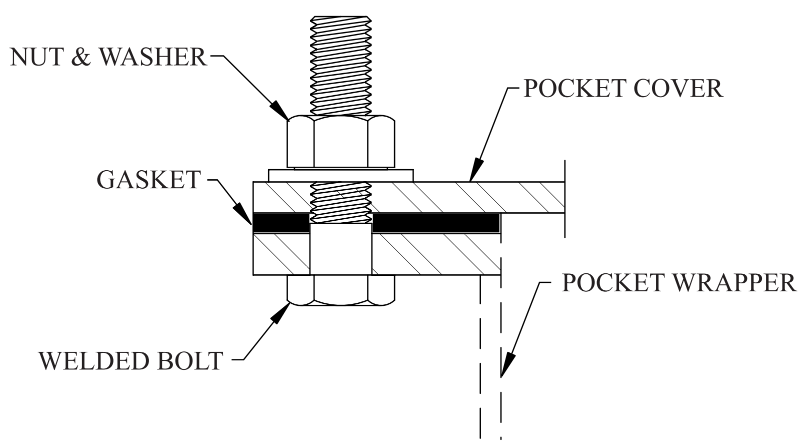
Bottom View

Data Sheet 2.L.11. 24" Pocket Closures.

2.L. 11. b. Authorized Non Standard 24" Pocket Closures. The 12 swing bolt configuration and bolted flange configurations are shown below.



12 Swing Bolt Pocket Closure



1984 Type Bolted Flange Pocket Closure

Data Sheet 2.L.11. (cont'd)

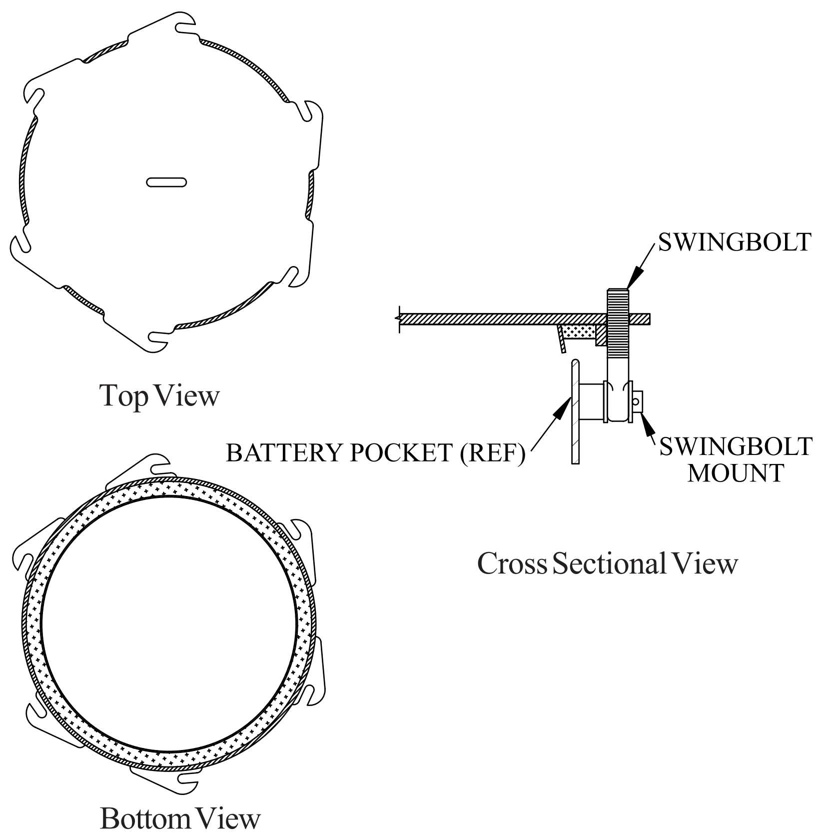
2.L. 12. <u>22" Pocket Closures</u>. Pocket closures are designed to ensure watertight integrity of the battery pockets on lighted buoys. The 22 inch pocket closure is used on 6X20 and 7X17 buoys. The standard 22 inch closure uses a swingbolt mount (welded to the buoy pocket), a flat neoprene gasket, a flat cover, and 6 stainless steel swingbolts. Pocket covers are delivered with a primer coat only. They shall be color coated to match the buoy.

a. <u>Standard Arrangement</u>. 22" Side-Swingbolt Closure.

<u>Reference Documents</u>. (use latest rev.)
G-SEC Drawing No. 121104
Specification No. 484

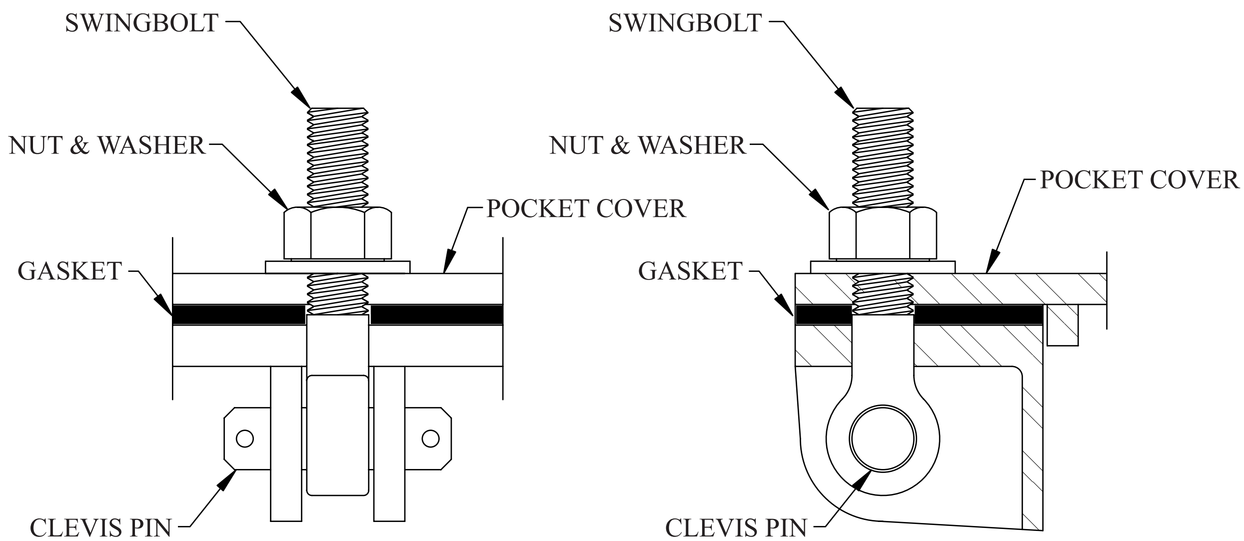
Stock Numbers:

22" Cover	NSN 6160-01-290-6897
Gasket (Roll)	NSN 5330-00-542-1984
Swingbolt & Nut (1)	NSN 5340-01-034-5222
Swingbolt Mount (6)	NSN 5315-01-288-0729

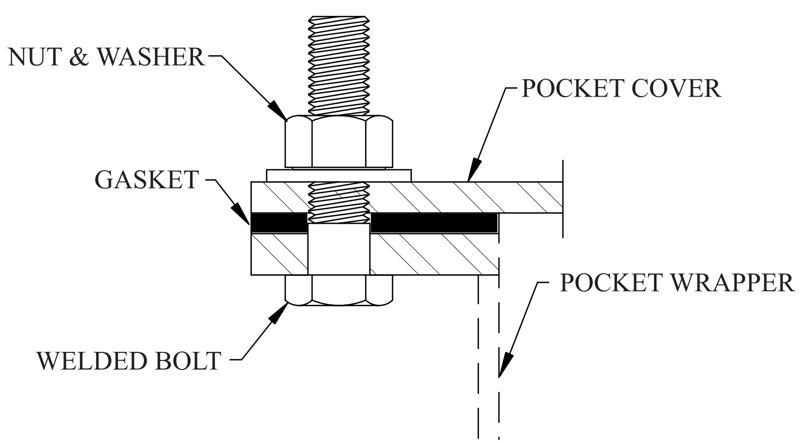


Data Sheet 2.L.12. 22" Pocket Closures.

2.L. 12. b. Authorized Non Standard 22" Pocket Closures. The 12 swing bolt configuration and bolted flange configurations are shown below.



12 Swing Bolt Pocket Closure



1984 Type Bolted Flange Pocket Closure

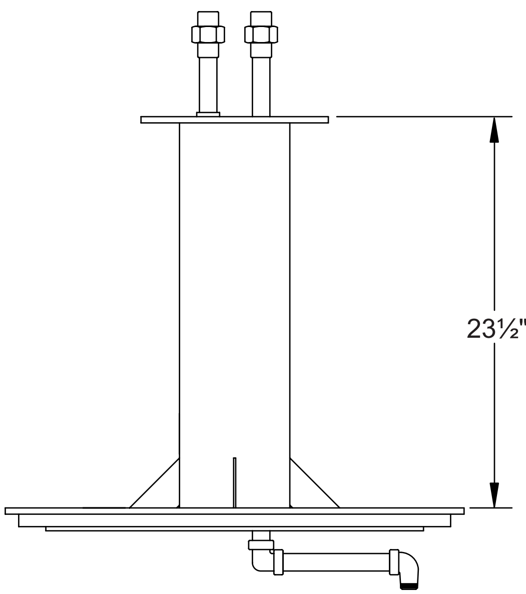
Data Sheet 2.L.12. (cont'd)

2.L. 13. <u>Pocket Closures for 3.5X8 and 5X11 Buoys.</u> 3.5X8 and 5X11 pocket closures have additional appendages welded on which contain the vent lines and support the buoy radar reflector. Pocket closures are delivered with primer coat only. They shall be color coated to match the buoy.

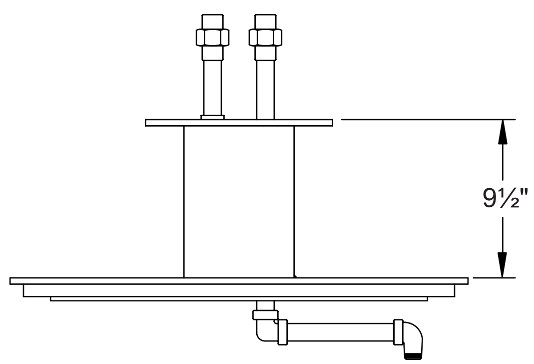
<u>Reference Documents</u>. (use latest rev.)
G-SEC Drawing No. 121160
G-SEC Specification No. 484

Stock Numbers:

3.5X8 Pocket Cover	NSN 6160-01-387-0206
5X11 Pocket Cover	NSN 6160-01-387-1643
Gasket (Roll)	NSN 5330-00-542-1984
Swingbolt & Nut (1)	NSN 5340-01-034-5222
Swingbolt Mount (6)	NSN 5315-01-288-0729



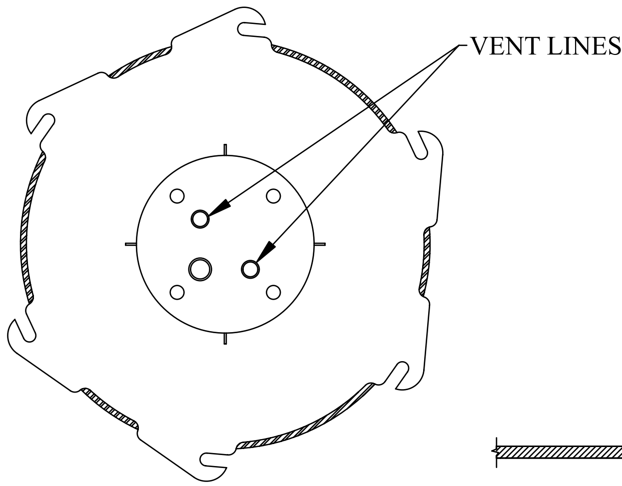
5X11 Pocket Cover



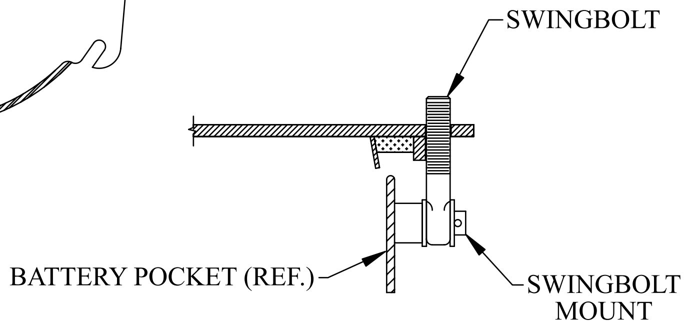
3-1/2x8 Pocket Cover

Data Sheet 2.L.13. 3.5X8 and 5X11 Pocket Closures.

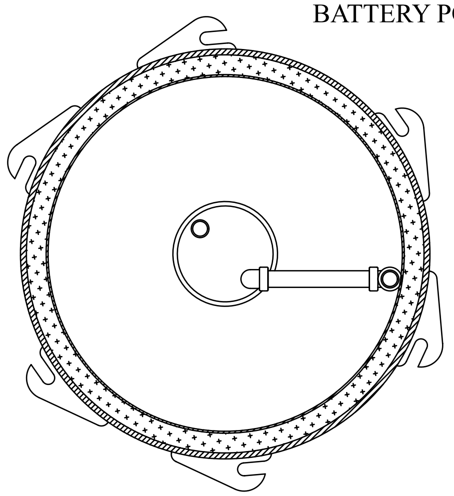
2.L. 13. Pocket Closures for 3.5X8 and 5X11 Buoys. (Cont'd).



Top View



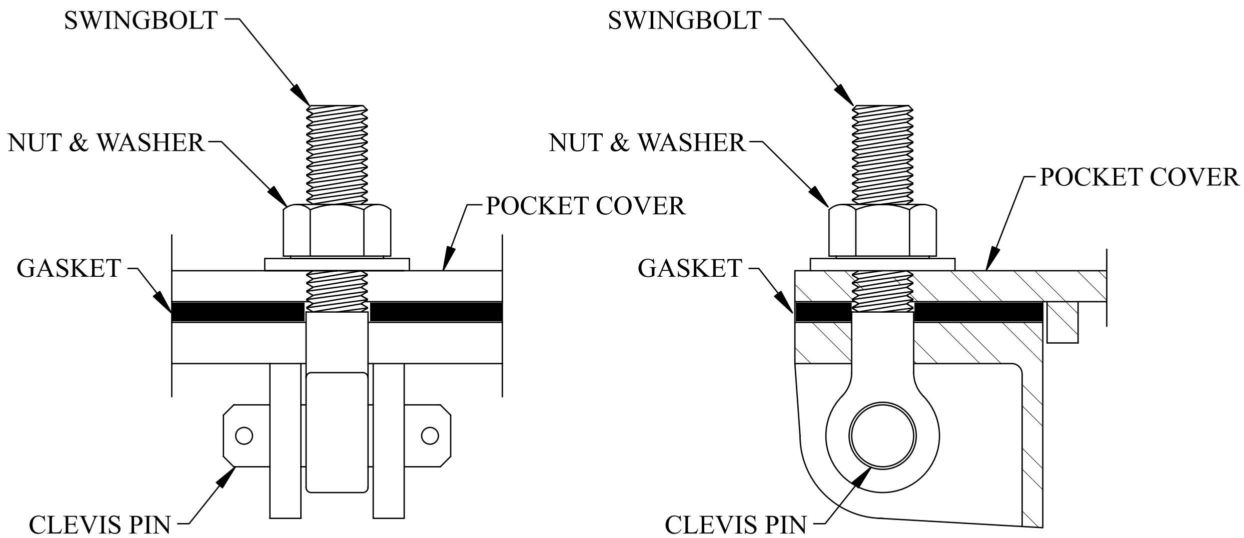
Cross Sectional View



Bottom View

Data Sheet 2.L.13. (con't).

2.L. 13. b. <u>Authorized Non Standard 3.5X8LR and 5X11LR Pocket Closures</u>. The 12 swing bolt configuration is shown below.



12 Swing Bolt Pocket Closure

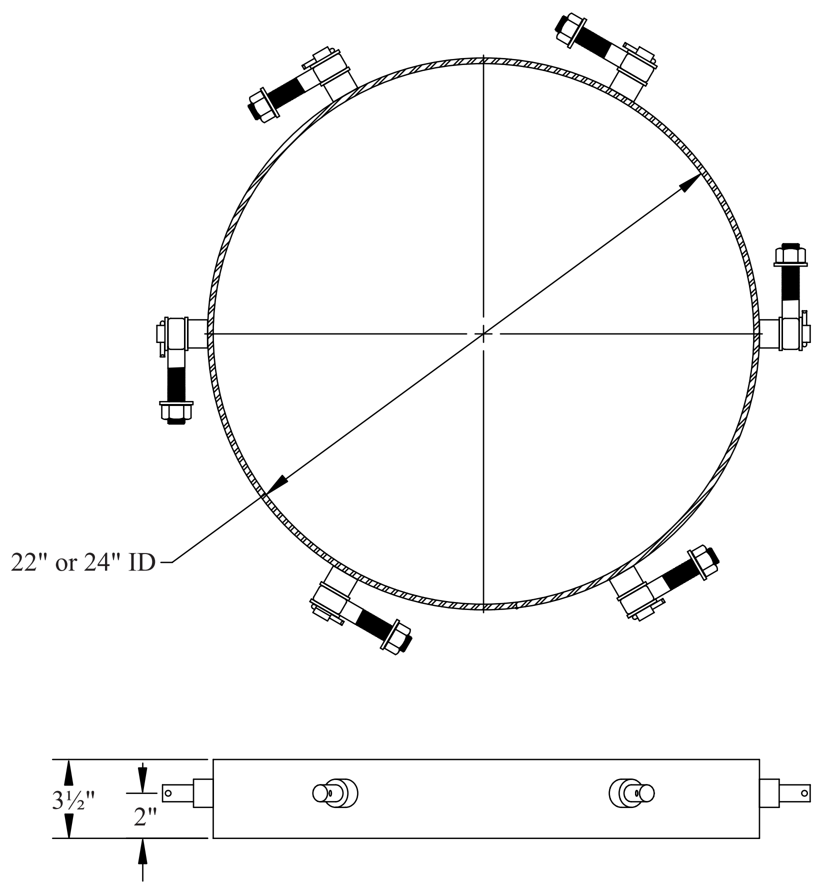
Data Sheet 2.L.13. (cont'd)

2.L. 14. Battery Pocket Conversion Kits. Battery pocket conversion kits are designed to replace non-standard pocket closures. Installation is completed by removing the non-standard pocket closure at the buoy top head and welding on the conversion kit. Conversion kits are available for 22 and 24 inch battery pockets. They include swingbolts and mounts, but do not include pocket covers. Battery pocket conversion kits are delivered with primer coat only. They shall be color coated to match the buoy.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121162
G-SEC Specification No. 484

Stock Numbers:

24" Conversion Kit	NSN 2040-01-391-5036
22" Conversion Kit	NSN 2040-01-391-5046
24" Pocket Cover	NSN 6160-01-386-9957
22" Pocket Cover	NSN 6160-01-290-6897



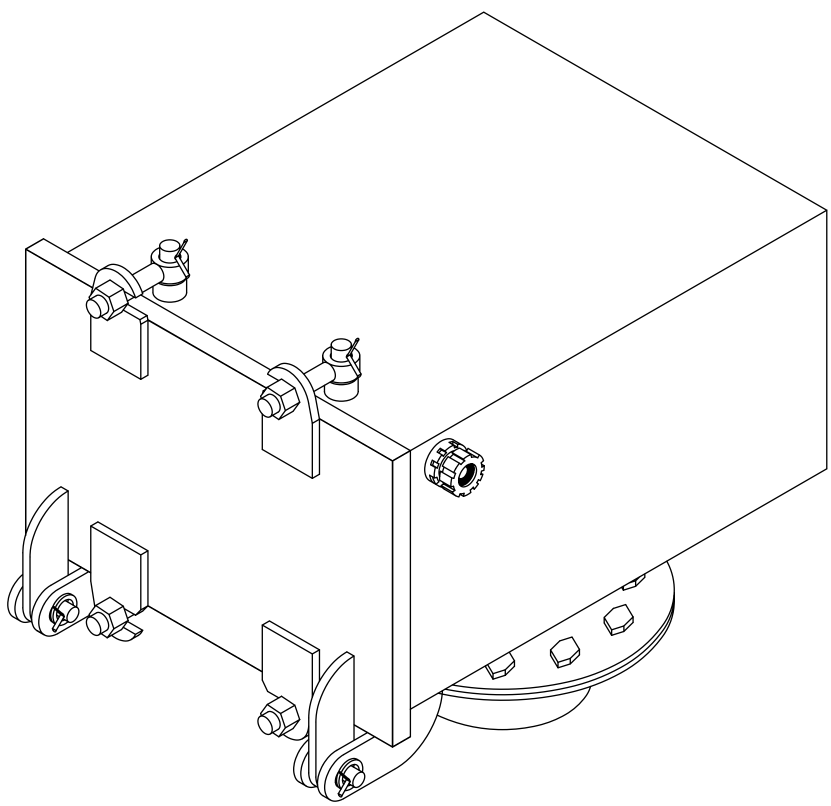
Data Sheet 2.L.14. Battery Pocket Conversion Kit.

2.L. 15. Buoy Battery Box. Steel battery boxes are intended for use on buoys with bell/gong mounting flanges. Each box requires a vent valve to release hydrogen gas. The valve is attached to a vent line coming out of the back of the box. Stainless steel mounting hardware is provided with each box.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121100
G-SEC Specification No. 460

Stock Numbers:

Double Battery Box	NSN 6160-01-335-3540
Vent Valve	NSN 4820-00-076-6748
PVC Reducer	NSN 4730-01-029-6548
Clevis Pin	NSN 5315-00-857-1453



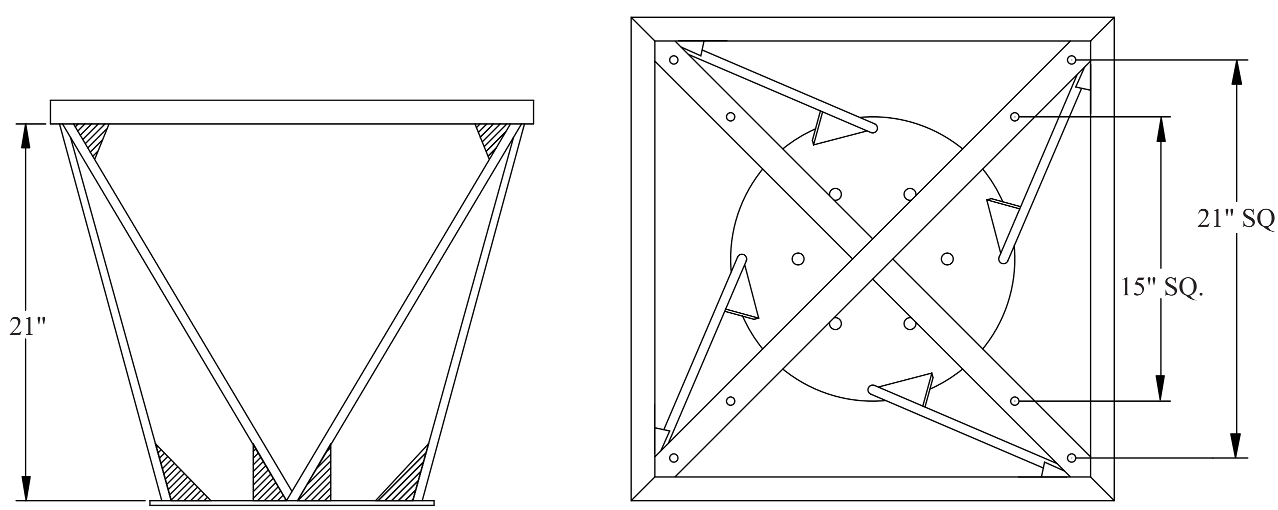
Data Sheet 2.L.15. Buoy Battery Box.

2.L. 16. Universal Solar Panel Frame. The universal solar panel frame is constructed from aluminum and designed to mount a single solar panel horizontally above the 155mm lantern. It is available in three sizes for use with the standard 10 watt, 20 watt, and 35 watt panels using the solar installation kit described in Chapter 6 of this manual. The larger size frame will accommodate the smaller panels, if necessary. The base of the frame is bolted directly to the lantern support flange on the buoy. The lantern is then installed on the same bolts and sits within the frame. As an option for areas with harsh environmental conditions, the frames may be fabricated locally from steel. Steel frames must be galvanized or painted a neutral color such as gray or silver. Mounting hardware is not provided.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121103
G-SEC Specification No. 461

Stock Numbers:

10 Watt Frame	NSN 6117-01-336-9133
20 Watt Frame	NSN 6117-01-336-9132
35 Watt Frame	NSN 6117-01-336-9131



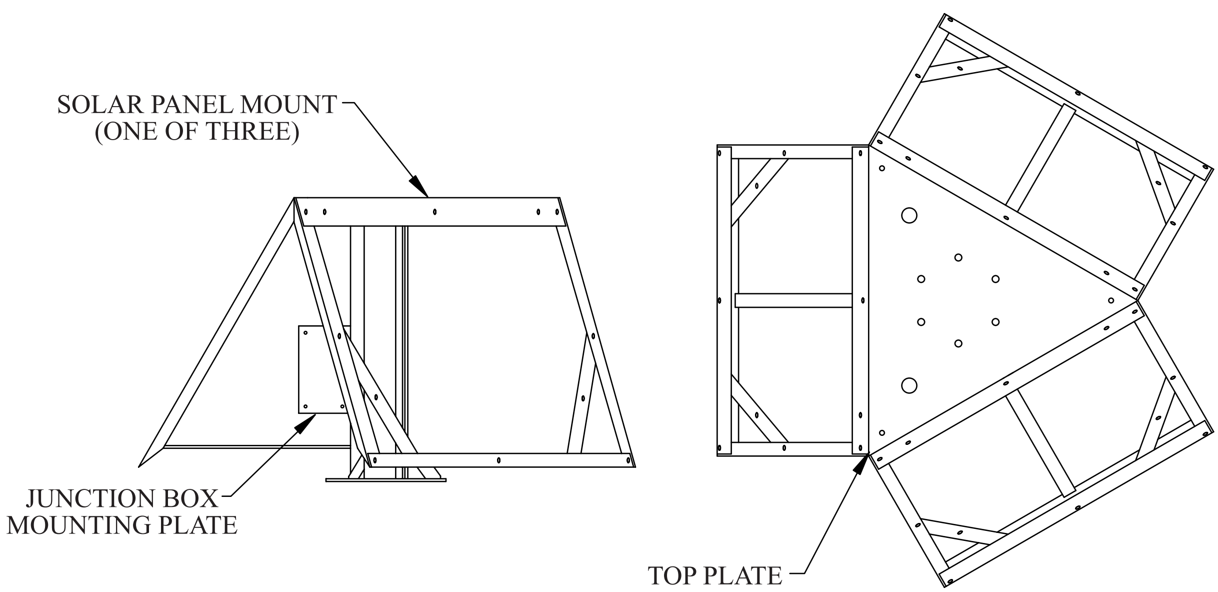
Data Sheet 2.L.16. Universal Solar Panel Frame

2.L. 17. Triple Solar Panel Frame. As its name implies, the triple solar panel frame is capable of holding up to three solar panels per frame. Frames for 10, 20, and 35 watt solar panels are available. The 20 watt frame will also accomodate 10 watt panels, and the 35 watt frame will also accomodate 20 watt panels. Mounting hardware is not provided.

Reference Documents: (use latest rev.)
G-SEC Drawing No.: 3X35 WATT 121135
3X20 WATT 121134
3X10 WATT 121133
G-SEC Specification No. 461

Stock Numbers:

3X35 WATT	NSN 6117-01-334-9295
3X20 WATT	NSN 6117-01-335-7377
3X10 WATT	NSN 6117-01-334-9292

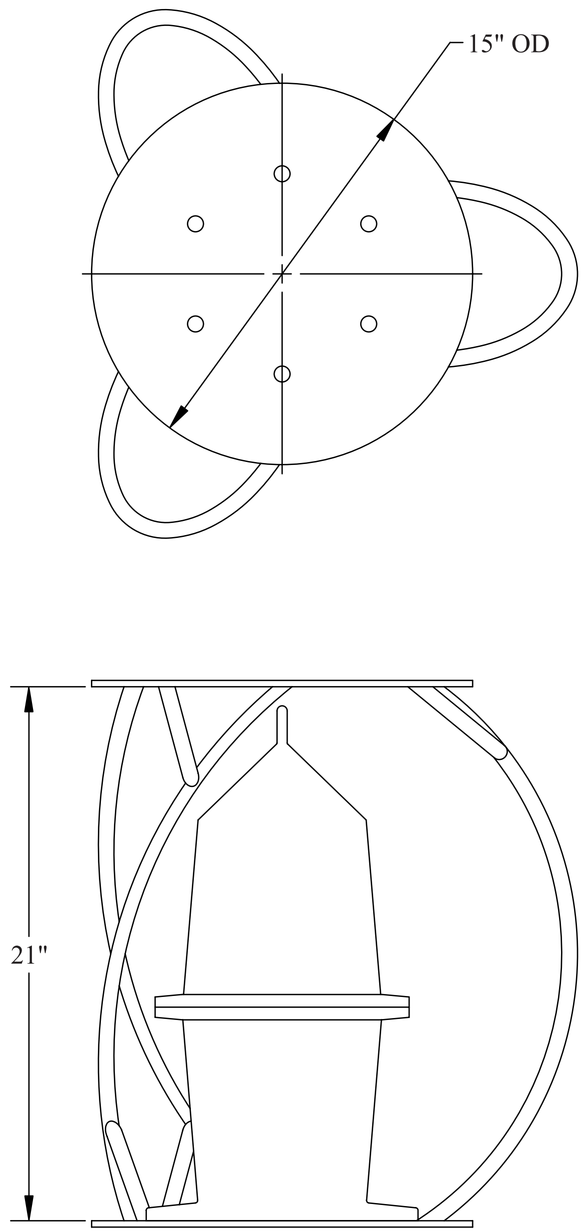


Data Sheet 2.L.17. Triple Solar Panel Frames.

2.L. 18. Lantern Bridge. This is an aluminum stand designed to hold the topmark above the lantern without hindering the lantern's signal. Mounting hardware is not provided.

Reference Documents: (use latest rev.)
G-SEC Drawing No. 121101
G-SEC Specification No. 499

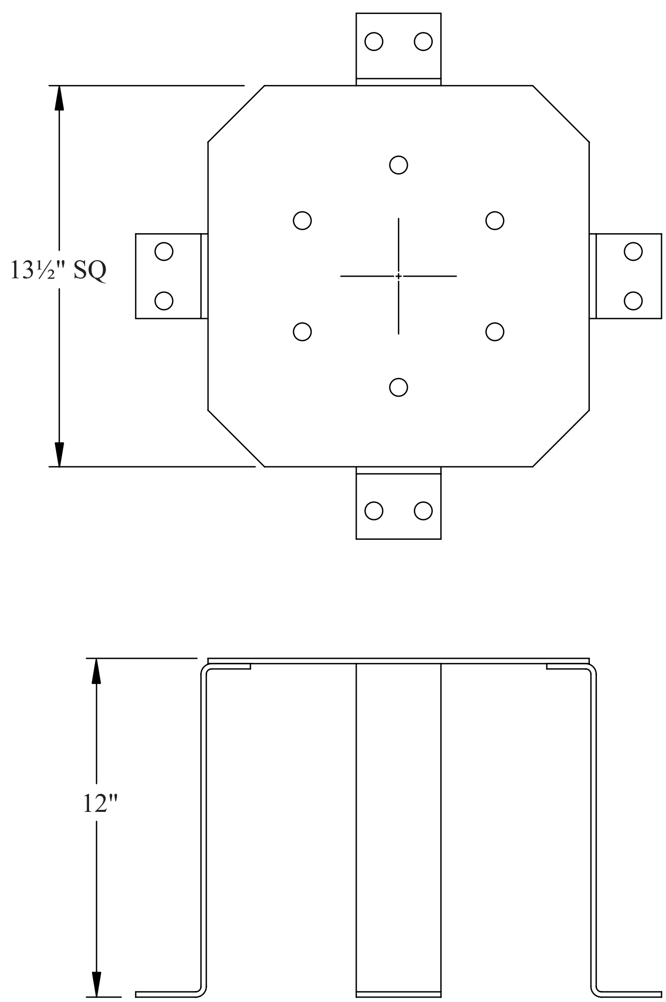
Stock Number: NSN 2050-01-312-9866



Data Sheet 2.L.18. Lantern Bridge.

2.L. 19. Topmark Support Flange. This is a steel flange that allows the installation of a topmark on unlighted can buoys by bridging the lifting eye. It is made from galvanized steel. The topmark support flange is mounted on the buoy by drilling eight 5/8 inch diameter holes in the top of the radar reflector and bolting it in place with stainless steel mounting hardware.

Reference Documents: (use latest rev.)
G-SEC Drawing No. 121141



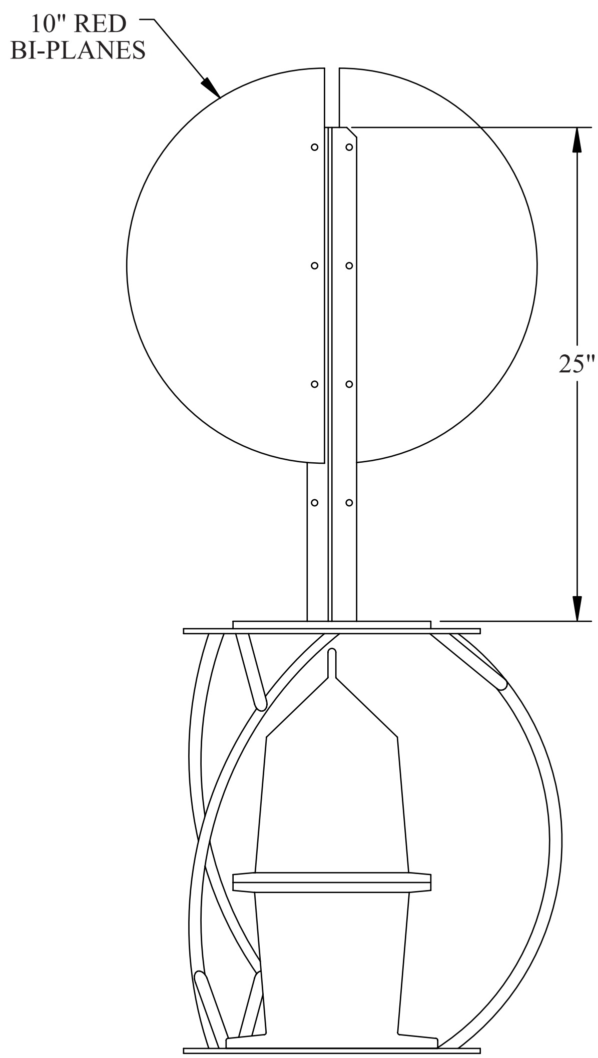
Data Sheet 2.L19. Topmark Support Flange.

2.L. 20. Safe Water Topmark. A single red spherical-shaped topmark is installed on buoys to designate areas of safe water in accordance with IALA requirements. The standard arrangement consists of 4 red (10" radius) bi-plane panels bolted to an aluminum stand.

Reference Documents: (use latest rev.)
G-SEC Drawing No.: Stand: 121138
Bi-Plane: 121144

Stock Numbers:

Short Stand	NSN 2050-01-334-9293
Lantern Bridge	NSN 2050-01-312-9866



Data Sheet 2.L.20. Safe Water Topmark.

2.L.20. Bi-plane Construction. The bi-planes are to be constructed out of either High or Medium Density Overlay (HDO, MDO) plywood.

Source of Supply. These are not available in the supply system. It is the responsibility of the unit to procure them locally or obtain them through their cognizant Industrial Support Command (ISC) or Group Industrial, as applicable.

Signal Coloring. The signal color for the topmarks can be achieved in one of two ways. The preferred alternative is to apply the same elastomeric film that is currently used on dayboards. Either pressure sensitive or heat-activated adhesives are acceptable. After applying the film to both sides of the bi-plane, the edges shall be coated with a sealant to prevent moisture intrusion. Painting the bi-planes is another option. The paints shall be suitable for long-term exposure to the marine environment. For optimal performance, a primer shall be applied to the surface first, followed by a topcoat of the appropriate color. The paints shall be applied to the surfaces and edges of the bi-planes. Whether film or paint is used, the surfaces of the bi-planes shall be lightly sanded first to ensure proper adhesion.

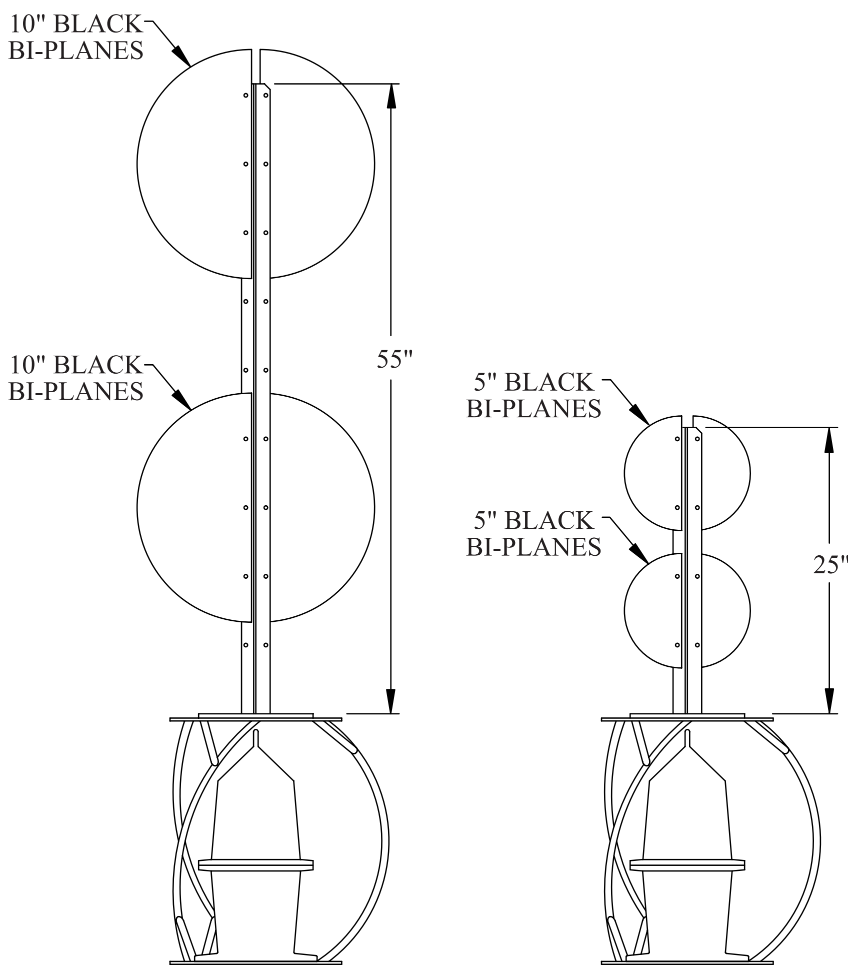
Connecting Bi-planes to Stand. To mount the plywood bi-planes to the aluminum topmark stand use 1/4"-20 X 1-1/4" hex bolts, nuts, and washers.

2.L. 21. Isolated Danger Topmark. Two black spherical-shaped topmarks are installed on buoys to designate areas of isolated danger in accordance with IALA requirements. The standard arrangement consists of two sets of 4 black (either 5" or 10" radius) bi-plane panels bolted to an aluminum stand.

Reference Documents: (use latest rev.)
G-SEC Drawing No.: Stand: 121138
Bi-Plane: 121144
G-SEC Specification No. 499

Stock Numbers:

Tall Stand	NSN 2050-01-334-8666
Short Stand	NSN 2050-01-334-9293
Lantern Bridge	NSN 2050-01-312-9866



Data Sheet 2.L.21. Isolated Danger Topmark.

2.L.21. Bi-plane Construction. The bi-planes are to be constructed out of either High or Medium Density Overlay (HDO, MDO) plywood.

Source of Supply. These are not available in the supply system. It is the responsibility of the unit to procure them locally or obtain them through their cognizant Industrial Support Command (ISC) or Group Industrial, as applicable.

Signal Coloring. The signal color for the topmarks can be achieved in one of two ways. The preferred alternative is to apply the same elastomeric film that is currently used on dayboards. Either pressure sensitive or heat-activated adhesives are acceptable. After applying the film to both sides of the bi-plane, the edges shall be coated with a sealant to prevent moisture intrusion. Painting the bi-planes is another option. The paints shall be suitable for long-term exposure to the marine environment. For optimal performance, a primer shall be applied to the surface first, followed by a topcoat of the appropriate color. The paints shall be applied to the surfaces and edges of the bi-planes. Whether film or paint is used, the surfaces of the bi-planes shall be lightly sanded first to ensure proper adhesion.

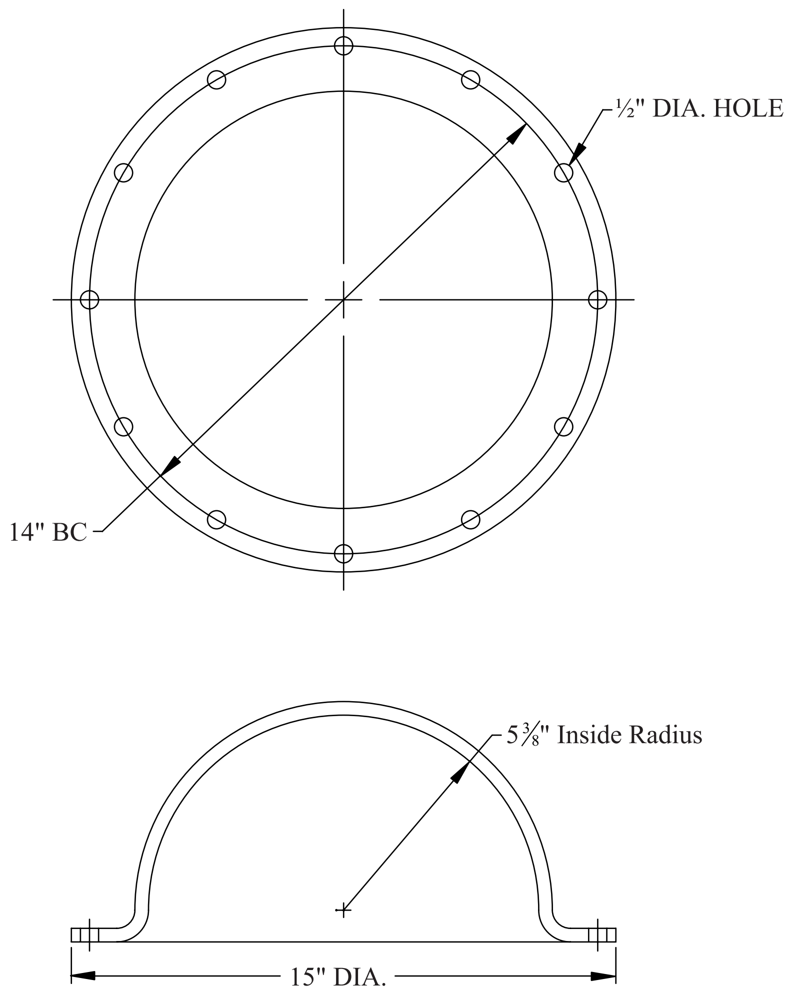
Connecting Bi-planes to Frame. To mount the plywood bi-planes to the aluminum topmark stand use 1/4"-20 X 1-1/4" hex bolts, nuts, and washers.

2.L. 22. Ice Buoy Domes. Ice buoy domes protect the lanterns on lighted ice buoys. The clear polycarbonate plastic domes are installed with a gasket kit and support ring to provide a watertight seal. A modified 155mm lens is required (see chapter 6 of this manual) as well as the special mounting assembly listed below.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 120981
G-SEC Specification No. 345

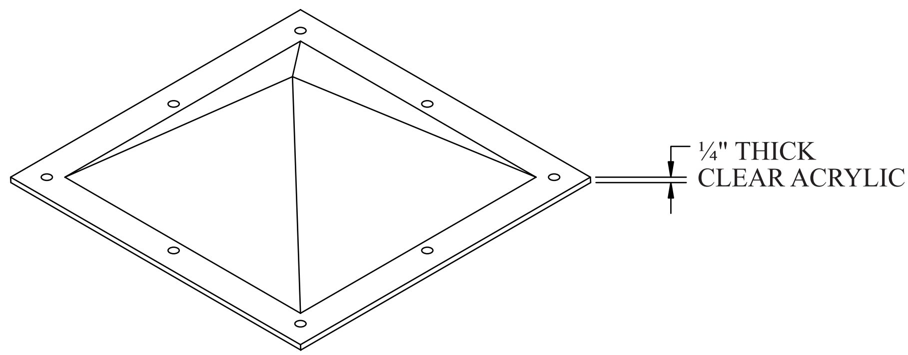
Stock Numbers:

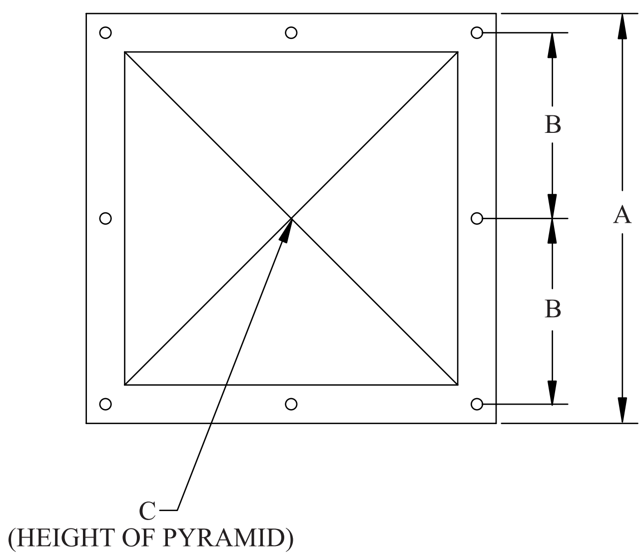
Dome	NSN 5340-01-305-5603
Gasket Kit	NSN 2050-01-132-2310
Support Ring	NSN 5365-01-137-2432
Bracket Assembly	NSN 2050-01-132-5376



Data Sheet 2.L.22. Ice Buoy Domes.

2.L. 23. Solar Panel Pyramid. The solar panel pyramid protects the solar panel from bird guano. The pyramids are made from 1/4 inch thick clear acrylic and have a flange for attachment to existing panel mounting bolts. They are available for 10, 20, and 35 watt solar panels. When calculating the solar power requirements, be aware that the pyramid reduces the power output of the solar panel by 35%.





SIZE	A	B	C
10 WATT	16"	7-1/2"	7"
20 WATT	22"	10-1/2"	10"
35 WATT	28"	13-1/2"	13"

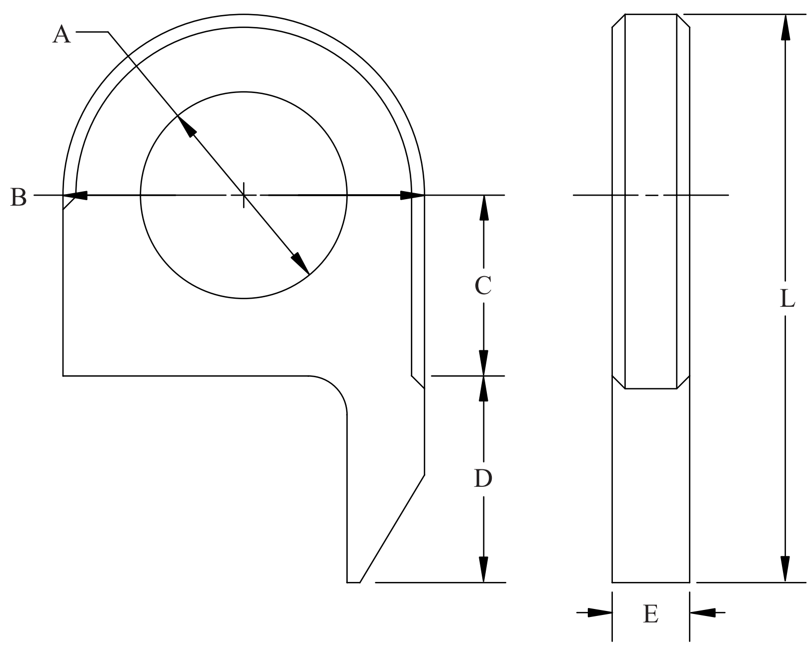
Data Sheet 2.L.23. Solar Panel Pyramid.

2.L. 24. Buoy Lift Eyes. Buoy lift eyes are made of steel plate.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121140
G-SEC Specification No. 500

Stock Numbers:

4X7 Lift Eye	NSN 2040-01-317-6432
5X9 Lift Eye	NSN 2040-01-317-6430
5X10 Lift Eye	NSN 2040-01-317-6431

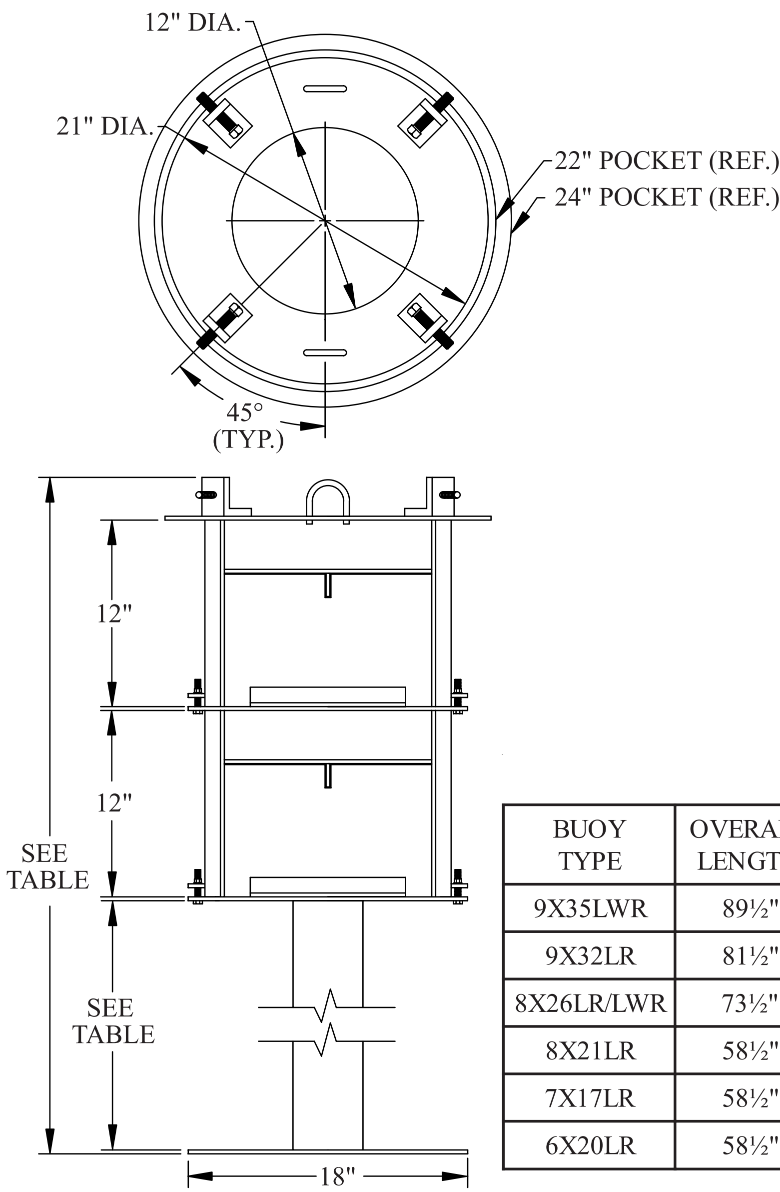


SIZE	A	B	C	D	E	L
4X7	4	7	3.5	5	1.5	12
5X9	5	9	4.75	7.25	2	16.5
5X10	5	10	5	9	2.25	19

Data Sheet 2.L.24. Buoy Lift Eyes.

2.L. 25. Buoy Pocket Battery Rack. The buoy pocket battery rack is designed to hold up to 8 batteries. The battery rack is designed to fit in either a 22" buoy pocket or a 24" buoy pocket.

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121178



		PIPE LENGTH		
BUOY TYPE	OVERALL LENGTH	4 BATTERY RACK	6 BATTERY RACK	8 BATTERY RACK
9X35LWR	89½"	62"	49¾"	37½"
9X32LR	81½"	54"	41¾"	29½"
8X26LR/LWR	73½"	46"	33¾"	21½"
8X21LR	58½"	31"	18¾"	6½"
7X17LR	58½"	31"	18¾"	6½"
6X20LR	58½"	31"	18¾"	6½"

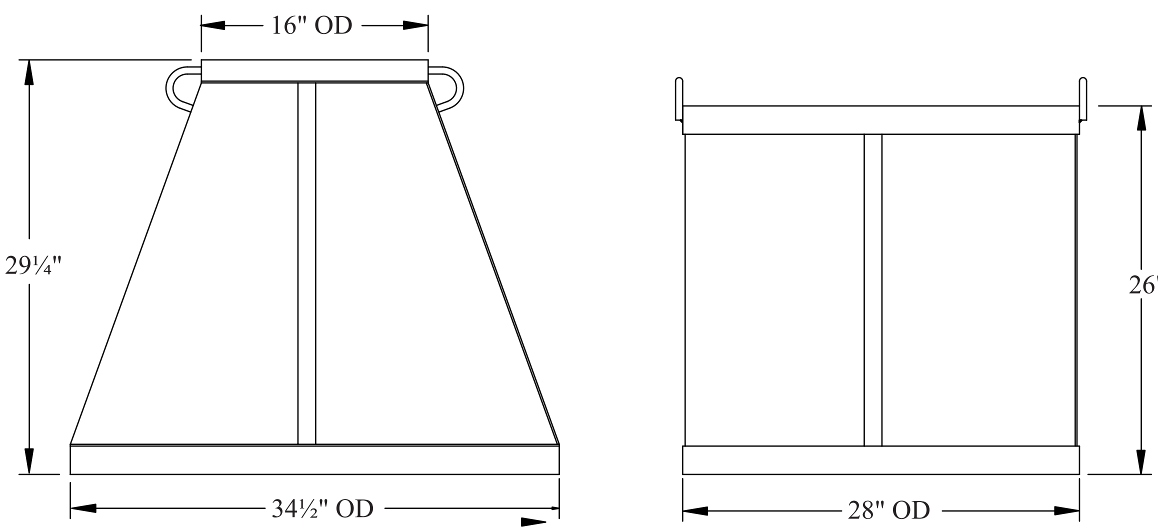
Data Sheet 2.L.25. Buoy Pocket Battery Rack.

2.L. 26. Radar Reflector. Aluminum can and nun radar reflectors are available for 5X9LFR, 5X11LR, and 3 1/2X8LR buoys. Radar reflectors are delivered with a primer coat only. They shall be color coated to match the buoy.

Reference Documents: (use latest rev.)
G-SEC Drawing No.: 121024 (Can Radar Reflector)
120316 (Nun Radar Reflector)
G-SEC Specification No. 374

Stock Numbers:

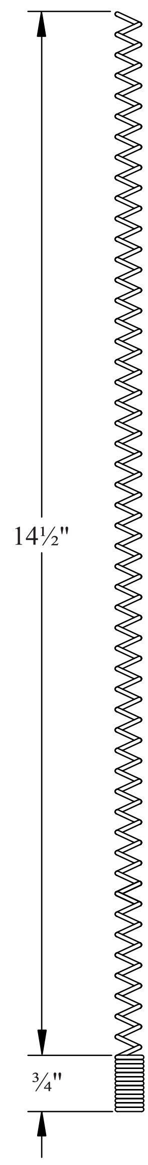
Can Radar Reflector	NSN 5840-01-043-6233
Nun Radar Reflector	NSN 5840-01-261-9882



Data Sheet 2.L.26. Radar Reflector.

2.L. 27. Solar Panel Bird Springs. Bird springs are stainless steel springs mounted on the corners of the solar panel. They are designed to keep guano off the solar panel by discouraging birds from roosting on the panel. Bird springs are delivered in lots of 25.

Stock Number NSN 5360-01-100-3111

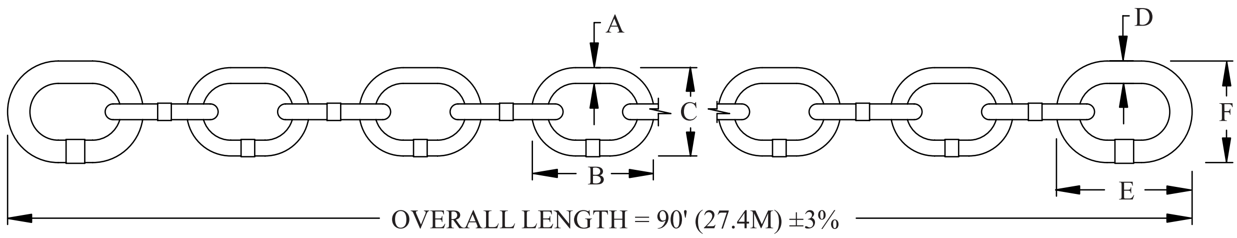


Data Sheet 2.L.27. Solar Panel Bird Springs.

2.M. Buoy Mooring Equipment. Buoy mooring equipment is presented in this section.

2.M. 1. Buoy Chain. Buoy chain connects the buoy to the sinker.

a. Reference Documents. (use latest rev.)
G-SEC Drawing No. 121032
G-SEC Specification No. 377
MOORSEL (Computer Aided Mooring Selection Guide)



DIMENSIONS (INCHES)						PHYSICAL VALUES				
COMMON LINKS			END LINKS*			PROOF LOAD	BREAK LOAD	WEIGHT (LBS/FT)	DRY	DRY SHOT WEIGHT (LBS)
A	B	C	D	E	F					
1/2	3	1-7/8	3/4	4-1/2	2-11/16	7,500	15,000	2.33	2.03	210
3/4	4-1/2	2-11/16	7/8	5-1/4	3-1/8	16,000	32,000	4.88	4.24	440
7/8**	5-1/4	3-1/8	1-1/8	6-3/4	4	22,000	44,000	6.61	5.75	595
1	6	3-9/16	1-1/4	7-1/2	4-7/16	29,000	58,000	8.33	7.24	750
1-1/8	6-3/4	4	1-1/4	7-1/2	4-7/16	38,500	77,000	10.55	9.17	950
1-1/4	7-1/2	4-7/16	1-1/2	9	5-5/16	45,500	91,000	13.33	11.59	1,200
1-1/2	9	5-5/16	1-7/8	11-1/4	6-11/16	65,500	131,000	19.33	16.8	1,740
1-5/8**	9-3/4	5-13/16	1-7/8	11-1/4	6-11/16	76,500	163,000	22.52	19.59	2,027
1-3/4	10-1/2	6-1/4	2-1/8	12-3/4	7-7/16	86,500	173,000	26.11	22.70	2,350
1-7/8	11-1/4	6-11/16	2-1/8	12-3/4	7-7/16	100,000	200,000	30.00	26.08	2,700
2	12	7-1/8				116,000	232,000	34.33	29.85	3,090
2-1/8	12-3/4	7-9/16				131,000	262,000	38.66	33.62	3,480
2-1/4	13-1/2	8-1/16				147,000	294,000	43.44	37.78	3,910

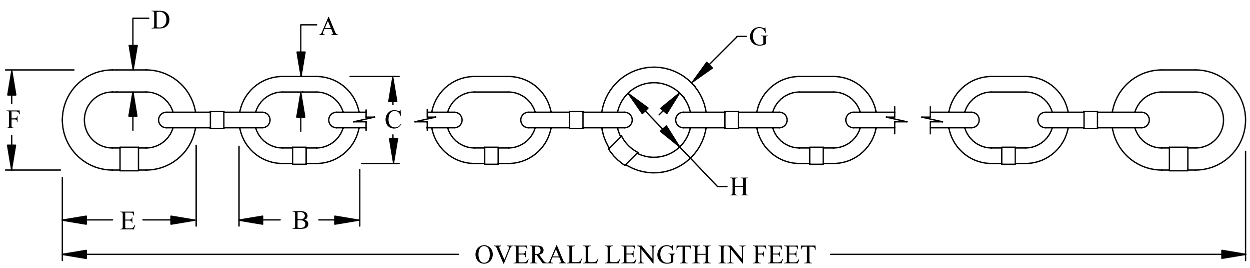
* End links are currently provided on 1/2" chain only. The dimensions for end links on the other chain sizes are shown in this table for reference purposes.

** 7/8" and 1-5/8" chain is no longer being manufactured. The dimensions for these chain sizes are shown in this table for reference purposes.

Data Sheet 2.M.1. Buoy Chain.

2.M. 2. Buoy Bridles. A buoy bridle is used to distribute the mooring load to the buoy mooring eyes. Bridles are fabricated from buoy chain and contain a large round link in the center for the mooring connection.

a. Reference Documents. (use latest rev.)
G-SEC Drawing No. 121031
G-SEC Specification No. 377
MOORSEL (Computer Aided Mooring Selection Guide)

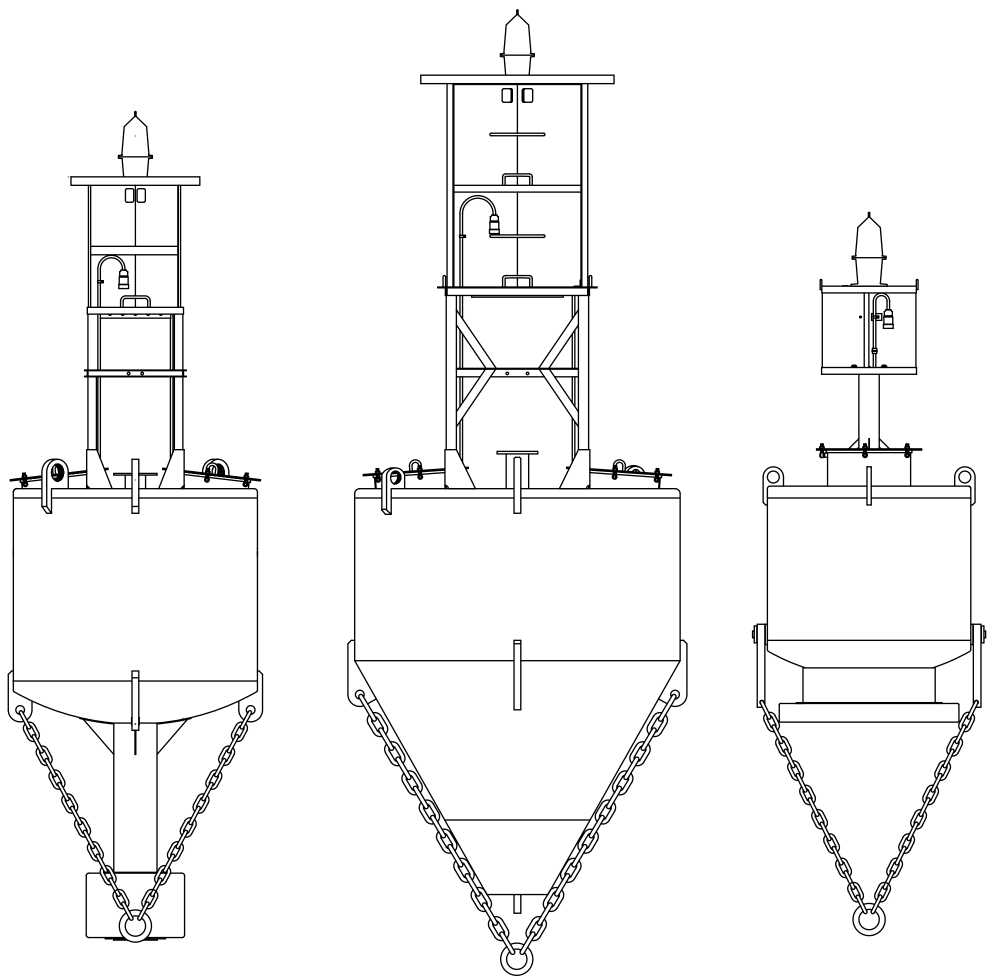


DIMENSIONS (INCHES)									PHYSICAL VALUES			
COMMON LINKS			END LINKS			RING		LENGTH	PROOF	BREAK	WEIGHT (LBS)	
A	B	C	D	E	F	G	H	FEET	LOAD (LBS)	LOAD (LBS)	DRY	WET
7/8	5-1/4	3-1/8	1-1/8	6-3/4	4	1-1/4	6	10	22,000	44,000	70	61
1	6	3-9/16	1-1/4	7-1/2	4-7/16	1-3/4	6	12	29,000	58,000	120	104
1-1/4	7-1/2	4-7/16	1-1/2	9	5-5/16	1-3/4	6	15	45,500	91,000	212	184
1-1/2	9	5-5/16	1-7/8	11-1/4	6-11/16	2-1/4	8	18	65,500	131,000	400	348
1-1/2	9	5-5/16	1-7/8	11-1/4	6-11/16	2-1/4	8	20	65,500	131,000	430	374
1-1/2	9	5-5/16	1-7/8	11-1/4	6-11/16	2-1/4	8	26	65,500	131,000	557	484

Data Sheet 2.M.2. Buoy Bridles.

2.M.2. Buoy Bridles. (Cont'd). The table and the figures below show the appropriate bridle for each buoy type, and the correct bridle placement for each of the three buoy bottom configurations.

Buoy Type	Bridle Size
9X38LR	1-1/2 x 26
9X35LWR	1-1/2 x 20
9X32LR	1-1/2 x 18
9X20R	1-1/4 x 15
8X26LR	1-1/4 x 15
8X26LWR	1-1/4 x 15
8X21LR	1-1/4 x 15
7X20LI	1-1/4 x 15
7X17LR	1-1/4 x 15
6X20LR	1 x 12
5X11LR	1 x 12
3.5X8LR	7/8 x 10



Data Sheet 2.M.2. (Cont'd).

2.M.3. Shackles. Shackles are used to connect lengths of buoy chain, and to attach the chain to bridles, sinkers, and buoys. They are made of forged or die-cast carbon steel. Shackles are of the split-key or rivet-pin type. Split-key shackles are used to connect the bridle to the buoy, the swivel to the bridle, the chain to the swivel, and the sinker to the chain. A split-key shackle assembly includes a stainless steel split-key which is inserted into the pin and bent open to prevent the pin from backing out. Rivet-pin shackles are used for splicing sections of chain together. They are assembled by heating and hammer forging the end of the pin, and are sometimes referred to as "heat and beat" shackles. **Note: Shackles shall not be used in the chafe section of the mooring.**

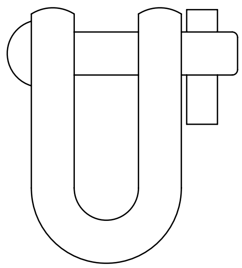
a. Reference Documents. (use latest rev.)
G-SEC Drawing No. 121079
G-SEC Specification No. 417

Stock Numbers:

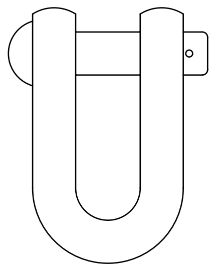
1st Class Split-Key Shackle Assembly	NSN 4030-00-236-8403
2nd Class Split-Key Shackle Assembly	NSN 4030-00-236-8402
3rd Class Split-Key Shackle Assembly	NSN 4030-01-286-6205
4th Class Split-Key Shackle Assembly	NSN 4030-01-286-6204
Special Class Split-Key Shackle Assembly	NSN 4030-00-527-8871
1st Class Rivet Pin-Shackle Assembly	NSN 4030-00-267-7077
2nd Class Rivet Pin-Shackle Assembly	NSN 4030-00-267-7079
3rd Class Rivet Pin-Shackle Assembly	NSN 4030-00-267-7078
4th Class Rivet Pin-Shackle Assembly	NSN 4030-00-729-6093
1st Class Split Key-Shackle Pin	NSN 5315-00-300-0370
2nd Class Split Key-Shackle Pin	NSN 5315-00-300-0369
3rd Class Split Key-Shackle Pin	NSN 5315-00-300-0368
4th Class Split Key-Shackle Pin	NSN 5315-00-300-0367
1st Class Rivet Pin-Shackle Pin	NSN 5315-00-300-0374
2nd Class Rivet Pin-Shackle Pin	NSN 5315-00-300-0373
3rd Class Rivet Pin-Shackle Pin	NSN 5315-00-300-0372
4th Class Rivet Pin-Shackle Pin	NSN 5315-00-300-0371
1st, 2nd, 3rd Class-Split Key	NSN 5315-00-161-4607
4th Class Split-Key	NSN 5315-00-161-4612
Special Class Split-Key	NSN 5315-00-148-2905

Data Sheet 2.M.3. Shackles.

2.M.3



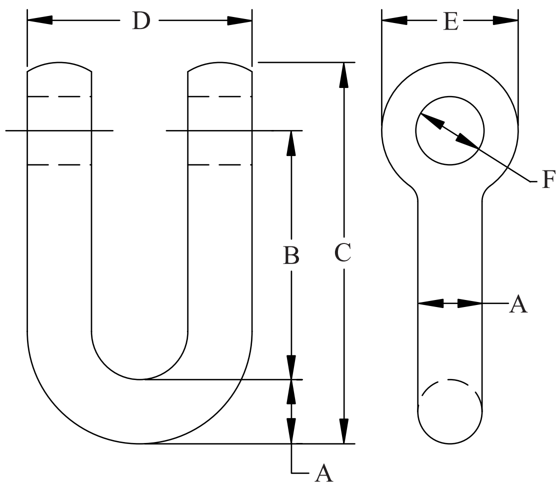
SPLITKEY
SHACKLEASSEMBLY



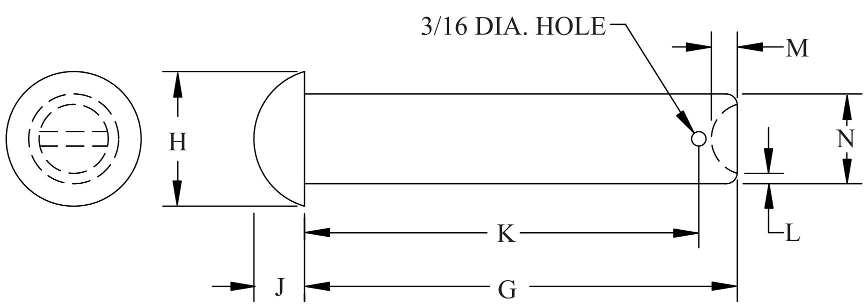
RIVETPIN
SHACKLEASSEMBLY

CLASS	PROOF LOAD	BREAKING LOAD	WEIGHT (APPROX.) DRY	WET
1st	115,000	230,000	40	35
2nd	90,000	180,000	27	23
3rd	65,000	130,000	16	14
4th	30,000	60,000	6	5
SPECIAL*	180,000	360,000	75	65

*SPLITKEY PINTYPEONLY



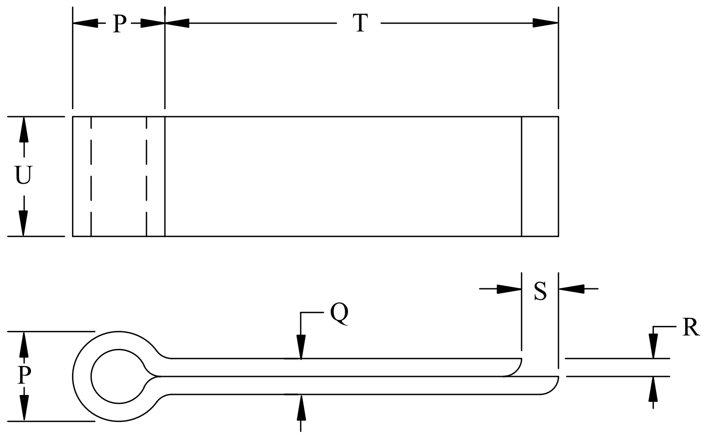
CLASS	A	B	C	D	E	F
1st	2	7-3/4	11-7/8	7	4-1/4	2-1/8
2nd	1-3/4	6-7/8	10-1/2	6-1/4	3-3/4	1-7/8
3rd	1-1/2	5-1/4	8-1/2	5-1/4	3-1/4	1-5/8
4th	1	4-1/8	6-1/2	4-1/4	2-1/2	1-1/8
SPECIAL	2-1/2	9	14-1/4	11	5-1/2	2-5/8
TOLERANCES	±1/16	±1/4	REF.	+3/16 -1/8	+1/4 -1/8	±1/32



CLASS	G	H	J	K	L	M	N
1st	8	3	1-1/8	7-1/4	3/16	3/8	2
2nd	7-1/8	2-3/4	1	6-1/2	3/16	3/8	1-3/4
3rd	6	2-1/2	7/8	5-1/2	3/16	1/4	1-1/2
4th	5	1-5/8	5/8	4-1/2	1/8	1/4	1
TOLERANCES	±1/16	±1/16	±1/64	±1/16	±1/32	±1/32	±1/32

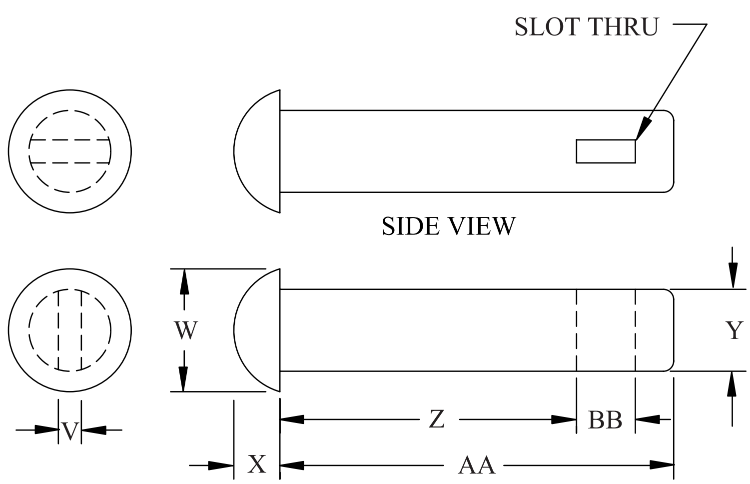
Data Sheet 2.M.3. (cont'd).

2.M.3



SPLIT KEY

CLASS	P	Q	R	S	T	U
1st, 2nd 3rd	15/16	3/8	3/16	3/8	4	1-1/4
4th	13/16	1/4	1/8	3/8	4	7/8
SPECIAL	1-1/16	3/8	3/16	3/8	5	1-1/4
TOLERANCES	±1/16	±1/32	±1/64	±1/16	±1/16	±1/32



SPLIT KEY PIN

CLASS	V	W	X	Y	Z	AA	BB
1st	9/16	3	1-1/8	2	7-1/2	9-5/8	1-7/16
2nd	9/16	2-3/4	1	1-3/4	6-1/2	8-7/8	1-7/16
3rd	9/16	2-1/2	7/8	1-1/2	5-1/2	7-7/8	1-7/16
4th	7/16	1-5/8	5/8	1	4-1/2	6-1/8	1-1/16
SPECIAL	9/16	3-1/2	1-3/8	2-1/2	11-1/4	13-3/4	1-7/16
TOLERANCES	±1/32	±1/16	±1/16	±1/32	±1/16	±1/16	±1/16

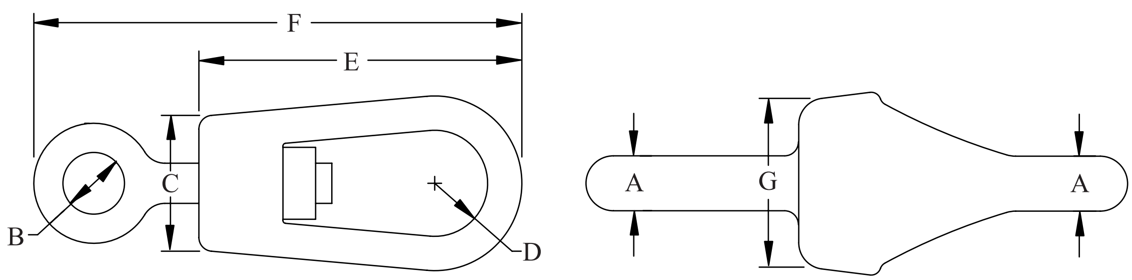
Data Sheet 2.M.3. (cont'd)

2.M.4. Swivels. Buoy swivels are included in the mooring to allow the buoy to twist without causing the chain to kink. They are forged or die-cast from carbon steel. Swivels are normally mounted between the bridle and the riser chain, but can be placed approximately one shot below the bridle depending on the water depth. They are never to be placed in the chafe zone. Swivels are to be installed with the round eye toward the bridle.

a. Reference Documents. (use latest rev.)
G-SEC Drawing No. 121081
G-SEC Specification No. 417

Stock Numbers:

1st Class Swivel	NSN 4030-00-729-6089
2nd Class Swivel	NSN 4030-00-729-6090
3rd Class Swivel	NSN 4030-00-729-6091
4th Class Swivel	NSN 4030-00-729-6094

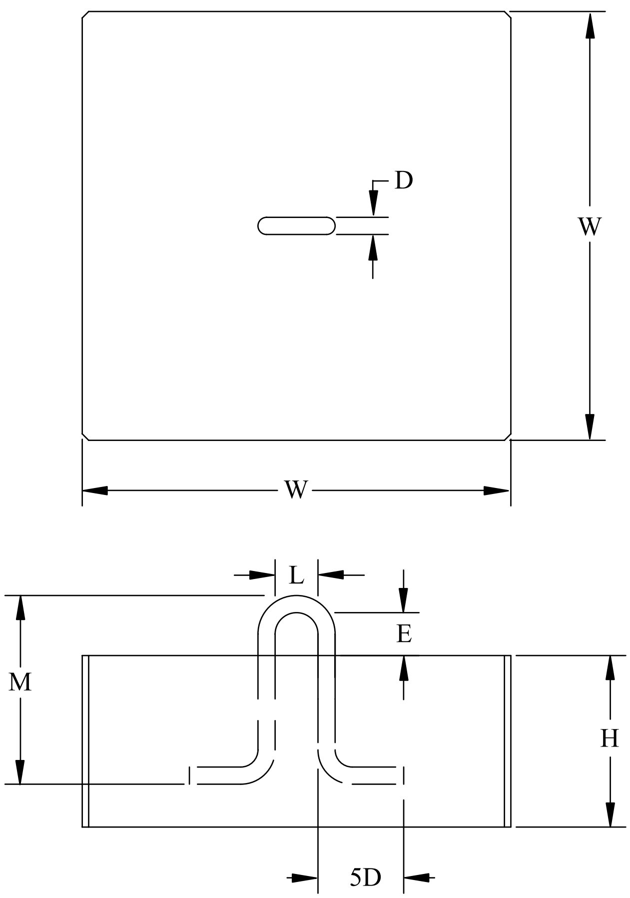


	DIMENSIONS (INCHES)							PROOF	BREAK	WEIGHT
CLASS	A	B	C	D	E	F	G	LOAD	LOAD	(LBS)
1ST	2	3	6	2-1/4	12	19-3/4	6-3/4	82,000	164,000	78
2nd	1-3/4	2-3/4	5	1-7/8	10-3/4	17-3/4	5-3/4	60,000	120,000	52
3rd	1-1/2	2-1/2	4-1/2	1-5/8	9-1/2	15-3/4	5	45,000	90,000	39
4th	1-1/4	2-1/4	4	1-1/2	7-3/4	13	4-1/2	30,000	60,000	19

Data Sheet 2.M.4. Swivels.

2.M. 5. Concrete Sinkers. Sinkers are used to hold the buoy in position. They are cheap, easy to fabricate locally, and can be retrieved for inspection. The sinker bail is fabricated from carbon steel and the concrete has a minimum tensile strength of 3000 psi. Concrete sinkers shall be cast in a single pour. **Buoy chain shall not be used for the sinker bail.** However, scrap buoy chain may be added to the sinker for additional weight. When this is done the actual weight of the sinker must be determined and the sinker must be permanently marked to show the actual weight.

a. Reference Documents. (use latest rev.)
G-SEC Drawing No. 121068
G-SEC Specification No. 407



Note: For 500 Lbs sinker and 250 lbs sinker, use the dimension "3D."

NOMIMAL	SINKER DIMENSIONS (IN.)					
WEIGHT(LBS)	W	H	D	L	E	M
20,000	70	51	2	5	5	22
18,000	70	46	2	5	5	22
15,000	70	38	2	5	5	22
12,500	60	43	2	5	5	22
8,500	60	30	2	5	5	22
6,500	60	23	2	5	5	22
5,000	50	25	2	5	5	22
4,000	50	20	2	5	5	22
3,000	50	15	2	5	5	17
2,000	36	20	1-1/2	5	5	22
1,000	36	10	1-1/2	5	5	12
500	22	14	1-1/2	5	5	17
250	22	8	1-1/2	5	5	11

Data Sheet 2.M.5. Concrete Sinkers.

2.M. 6. <u>DOR-MOR Anchor</u>. The DOR-MOR anchor is a cast iron, pyramid-shaped sinker. It is designed for use in areas with mud or sand bottoms. DOR-MORs are available in sizes ranging from 15 pounds to 4,000 pounds. Because cast iron is much denser than concrete, these anchors have significantly more holding power than concrete sinkers of the same weight. This means that sinker weight can be reduced while retaining equivalent holding power on station. For example, field tests have shown that 35-pound DOR-MORs can substitute for 100-pound concrete sinkers, 70-pound DOR-MORs for 500-pound concrete sinkers, and 135-pound DOR-MORs for 1,000-pound concrete sinkers. DOR-MORs in these sizes are especially useful for small plastic and foam buoys (4th class and below), which are typically serviced by units with limited weight handling capability. Larger DOR-MORs may also be used for special applications and unique situations where a traditional concrete sinker is not sufficient. Keep in mind, however, that the larger DOR-MOR anchors are significantly more expensive than the equivalent concrete sinkers.

DOR-MOR anchors may be purchased from:

DOR-MOR Inc.
RR 2, Box 476
Claremont, NH 03743
603-542-7696
www.dor-mor.com

Data Sheet 2.M.6. DOR-MOR Anchor.

CHAPTER 6. LIGHT SIGNALS

A. Introduction. This chapter describes the components of standard aids to navigation light signals—including the housing, lenses, lamps, lampchangers, flashers, daylight controls, and wiring. Unless otherwise authorized by Commandant, only standard equipment, as described in this chapter, may be used in new installations, or as replacements for existing equipment.

B. Selecting an AtoN Light Signal.

1. Criteria. COMDTINST M16510.2A, *Visual Signal Design Manual*, describes the standard procedures to follow when selecting an optical system for a lighted aid to navigation. In general, these procedures require the Waterways Manager to:

- State the operation requirement—in terms of the desired luminous range of the light for a specified percent of time. This is known as the *operational range*.
- Specify additional information about the aid—including the color of the light signal, rhythm, location, background lighting conditions, and focal height of the light (for lighthouses). This information is required to assist in determining equipment requirements to meet the stated operational range.
- Determine the geographic range of the light—to insure the light signal will be visible at the stated operational range. (Only required for lighthouses.)
- Determine the meteorological visibility—for the aid location.
- Calculate luminous intensity (I_e) required to meet the operational range.
- Apply correction factor for lantern panes—if necessary.
- Select optics that will meet the operational requirement. There may be more than one lens/lamp combination that meets the operational requirement. In that case, a decision needs to be made between competing engineering options as to which system provides the most cost-effective signal for the mariner.

2. Purpose of Nominal Range. The *nominal range* of a light plays no part in the selection process. Nominal range is the calculated luminous range of a light at night, with no background lighting and a meteorological visibility of 10 nautical miles. This value is used on nautical charts and in light lists to advertise the range at which mariners might expect to see a light, assuming clear conditions and no background lighting. It is a useful engineering concept, allowing comparison of the optical performance of different systems, but does not assure that a light can attain the required operational range. The nominal ranges provided by standard omnidirectional lanterns and rotating beacons are listed in the respective data sheets to assist in the preparation of light lists and charts.

6.B. 3. Light Signal Characteristics. A light signal may be colored and/or flashed to increase the conspicuity of the light against its background.

a. Colors of Light Signals. The color of a minor aid light signal is usually determined by its purpose; whether a lateral aid, safewater mark, isolated danger mark, etc. COMDTINST M16500.7, *Aids to Navigation Manual—Administrative* (AtoN Admin Manual), prescribes the colors for the various purposes for which minor aids are used. Light signals for major aids were often colored to assist in identification of the aid.

b. Rhythm. There are eight basic classes of rhythms used by the Coast Guard:

Flashing................displaying a single flash at regular intervals, the duration of light being less than the duration of darkness;
Quick flashing......displaying not less than 60 flashes per minute;
Group flashing .....displaying groups of two or more flashes, the groups being separated by a longer interval of darkness;
Morse ....a group rhythm, with the flashes of different duration so as to produce a Morse characteristic;
Alternating ....displaying different colored flashes of light;
Isophase................displaying equal intervals of light and darkness;
Occulting..............displaying a single flash at regular intervals, the duration of light being greater than the duration of darkness; and
Fixed ....the light signal is fixed on, with no periods of darkness.

(1) Omnidirectional lanterns and range lanterns may be flashed by use of a solid-state device that switches the lamp circuit on and off in a prescribed manner. Rotating beacons generate a regular pattern of flashes by their very nature. The pattern may be varied by use of multiple emitters. For example, the DCB224 rotating beacon has two optical heads that may be oriented so that the timing between flashes is equal (beams set 180 degrees apart) or so that the two flashes are grouped, with a longer interval between the second flash and the beginning of a new group. The VRB-25 rotating beacon may be outfitted with six lenses, or combinations of lenses and blanking panels, to provide a variety of characteristics. An alternating characteristic, where the light signal is made up of flashes of different colors, can only by produced by a rotating beacon.

6.B.3.b. (2) The Coast Guard has adopted a relatively small number of rhythms for general use. Rhythms that are produced by standard Coast Guard flashers are described in Table 6-1.

Table 6-1
Standard Coast Guard Rhythms

Classification	Rhythm	ON/OFF times (sec)	Duty Cycle %
Quick Flashing	Q	0.3/0.7	30
Flashing	Fl 2.5 (0.3)	0.3/2.2	12
Flashing	Fl 2.5 (1)*	1.0/2.5	40
Flashing	Fl 4 (0.4)	0.4/3.6	10
Flashing	Fl 4 (1.0)*	1.0/3.0	25
Flashing	Fl 6 (0.6)	0.6/5.4	10
Flashing	Fl 6 (1.0)*	1.0/5.0	17
Group Flashing	Fl (2 + 1) 6	0.3/0.4/0.3/1.2/0.3/3.5	15
Group Flashing	Fl (2) 5	0.4/0.6/0.4/3.6	16
Group Flashing	Fl (2) 6	1.0/1.0/1.0/3.0	33
Morse	Mo (A)	0.4/0.6/2.0/5.0	30
Isophase	Iso 2	1.0/1.0	50
Isophase	Iso 6	3.0/3.0	50
Occulting	Oc 4	3.0/1.0	75
Fixed	F	——	100

* Rhythms developed for 12-volt 100 and 110-watt lamps.

(3) The AtoN Admin Manual prescribes the characteristics displayed by most minor aids. Characteristics for major aids are generally historical in nature, and were originally selected to assist the mariner in identification of the aid.

4. Equipment Selection. Following the criteria provided in the Visual Signal Design Manual, the Waterways Manager is usually afforded several options to meet the operational requirements of an AtoN light. These options may be limited, however, by other issues.

a. Structure Limitations. One possible restriction on equipment selection is the structure on which it will be mounted. Only the 155mm and 200mm buoy lanterns may be installed on buoys or wooden single-pile structures located in the water. The 200mm buoy lantern is specifically designed for use where light-to-moderate icing is expected, and on exposed bars and jetties subject to breaking water. The 250mm and 300mm marine lanterns

6.B.4.a. (cont'd) are restricted to use on stable platforms. Rotating beacons should also be installed on structures that are not subjected to noticeable vibration. Some vibration may be damped by installation of Army-Navy rubber grommets between the mounting plate and the beacon base. The VRB-25 rotating beacon data sheet illustrates installation of vibration dampening grommets.

b. Available Power. Another consideration in selecting lighting equipment is the availability of reliable commercial power. Commercial-power systems are generally simpler than those using solar power. In addition, although the 120-volt four-place lampchanger (CG-4P) holds fewer lamps than the 12-volt six-place lampchanger (CG-6P), the expected lamp life of the 120-volt, 150 watt and 250 watt lamps is 2000 hours, as opposed to 500 to 1000 hours for 12-volt marine signal lamps. Thus, use of commercial power and 120-volt lamps may allow for extending the service interval of an AtoN light (see Section D, below).

c. Modernization and Characteristics. Replacement of a "classical" lens with a modern optic may lead to difficulty in matching the characteristic with the required luminous intensity. This difficulty is exacerbated for projects intended to solarize aids with large omnidirectional lanterns. Classical lenses do not provide an acceptable light signal when outfitted with 12-volt lamps, thus, conversion to solar power REQUIRES installation of modern, standard optics. The largest modern omnidirectional lantern that can be outfitted with 12-volt lamps, the 300mm marine lantern, can not provide a luminous intensity equal to that of even the smallest classical lens outfitted with 120-volt lamps; and rotating beacons can not replicate the characteristics generated by flashed, omnidirectional lanterns.

These limitations may necessitate a change to an historic characteristic, a reduction in the operational range, or both, when replacing an existing optic. Compromises of this nature should not be required for installation of a new aid to navigation. It is the responsibility of the Waterways Manager to balance the cost of an aid with the service provided. The use of standard hardware is the best means to achieving that balance.

5. Range Equipment Selection. A separate selection process is used for range lights. COMDTINST M16500.4B, *Range Design Manual*, describes the *Range Design Program*, which provides minimum and recommended intensities for lights for a given range configuration. With this information, the Waterways Manager can identify the lens/lamp combinations that provide acceptable light signals. The light signals may be provided by omnidirectional lanterns or range lanterns. The benefit of an omnidirectional lantern is that the signal is visible while a vessel is off-axis, providing positional information to the mariner along a perpendicular approach to the channel axis. The greater intensity provided by range lanterns, however, is usually required for channel lengths longer than two miles.

6.B.5. a. Traditionally range lights were secured during daytime, with dayboards providing the daytime signal. Improvements in optics, combined with solar power, have allowed expanded use of daytime lighted ranges, even when commercial power is not readily available. The Range Design Manual provides criteria to help the Waterways Manager determine the appropriate daytime signal (dayboards or lights).

b. Nighttime range lights should provide sufficient intensity to mark the entire channel for 90% of the nights. The "minimum intensity" values provided by the Range Design Program will provide adequate signals; however, higher intensities will provide better signals. Experience indicates that intensity values ten times greater than the minimum values are preferred. The "recommended intensity" provided by the Range Design Program is approximately ten times the minimum value required for the channel length and visibility conditions. The recommended value may be adjusted downward by the program, to provide good illuminance balance or compensate for potential glare.

c. Daytime range lights should be of sufficient intensity to maximize the percentage of time the channel is adequately marked. If the minimum intensity recommended by the Range Design Program can be met, there is no need to exceed that value. If the minimum intensity can not be met, the Waterways Manager should put in the brightest light possible.

d. Whenever possible, the nighttime and daytime characteristics, including signal color, should match. For very long channels, or in areas with poor visibility, the daytime light signals may have to be white, even though the historic color for the nighttime light signals is red or green.

e. Standard light rhythms for ranges are:

Front	Rear
Fixed*	Fixed*
Oc 4*	Oc 4*
Iso 6	Iso 6
Iso 2	
Fl 2.5 (1.0)	
Q**	

Notes: * Not recommended for solar power applications.
** Only for lamps rated for 2.03 amps or less.

6.B. 6. Nonstandard Equipment. Nonstandard equipment includes both items that have not been approved for standard use, such as directional (sector) lights, and items that are no longer centrally supported, such as assembled (classical) lenses.

a. Directional (Sector) Lights. Directional lights are a form of "single-station range" lights. The optical components project a horizontal array of encoded light signals, with precise boundaries between one signal and the next. The usual means of encoding the light signals is by use of different colors, with red and green sectors on either side of a central, white sector (hence the name "sector lights"). The mariner maintains a track along the centerline of a channel by remaining within the white sector. If a vessel crosses a sector boundary, the mariner will observe a color change in the light signal. Additional colors are not normally used to generate more sectors, although the center sector may be amber or yellow, instead of white. Another means of encoding light signals to generate positional information is to display different flash rhythms in various sectors. By combining a changing flash rhythm across the colored sectors, a greater degree of positional information may be provided, without risking confusion through the addition of non-standard colors.

A standard two-station range is preferred over a directional light, as it provides not only positional information (relative to the channel centerline), but also provides information on whether a vessel is tending toward or away from the centerline. In general, that information is not provided by a directional light until a sector boundary is crossed. If you have a situation where it is not feasible to install a two-station range, call COMDT (G-SEC-2) for guidance on the potential application of a directional (sector) light.

b. Assembled (Classical) Lenses. Assembled, or "classical," lenses include both omnidirectional and rotating optics. They are made up of a collection of prisms and lenses that serve to collect and project the light emitted from a central source. Light sources initially used in classical lenses had low values of surface brightness, and were consequently fairly large to provide a sufficient amount of light to generate an AtoN signal. Since classical lenses were designed to use these large light sources, they do not provide adequate AtoN signals when outfitted with 12-volt marine signal lamps. Thus, aids with classical lenses are not candidates for solarization.

Guidance on the retention of classical lenses, where reliable mains power exists, may be found in paragraphs 2.B.2.a and 2.B.3 of COMDTINST M16500.8A, *Automation Technical Guidelines*. The effective intensities generated by classical lenses outfitted with 120-volt lamps are provided in the Visual Signal Design Manual.

C. Preparation and Installation.

1. Equipment Inspection. All AtoN lighting components should be inspected upon receipt. Electrical components, such as flashers, lampchangers, and rotating beacons, should be bench tested for 24 hours prior to being placed in service. When possible, lamps should be burned at rated voltage for a period of 8 hours to screen for infant mortality (the potential failure of a lamp at first start-up).

2. Servicing Guides & Manuals. COMDTINST M16500.17, *Alternating Current Aids to Navigation Servicing Guide* (AC Servicing Guide) and COMDTINST M16500.19A, *Short Range Aids to Navigation Servicing Guide* (Short Range Servicing Guide) provide specific installation instructions for 120-volt and 12-volt aids to navigation lighting components, respectively. In addition, major components, such as rotating beacons and range lanterns, are supplied with a manufacturer's installation and maintenance manual. Refer to these manuals prior to installation of a beacon or lantern and when performing preventive maintenance or troubleshooting.

3. Outfitting AtoN Lights. The various components, such as daylight controls, flashers, lampchangers, lamps, etc., that are used with an optic to make a complete AtoN light, are identified in the various lantern and beacon data sheets found in Section E of this chapter and in the Servicing Guides. Refer to the appropriate data sheet and the Servicing Guides for proper assembly of the light.

4. Wiring—12-volt DC. Requirements for wiring 12-volt solar powered aids are discussed in the Solar Design Manual. The information found herein provides general information on selection of appropriate wiring for AtoN lights. More detailed information will be found in COMDTINST M16500.24, *Solar Design Manual*, and the applicable Standard Configuration Drawings, available from the Civil Engineering Units.

    a. Conventions. Wires used for power leads and for internal wiring are color-coded. Power leads shall use BLACK as "Positive (+)" (12VDC) and WHITE as "Negative (-)" (0VDC). Internal wiring of an optical assembly uses RED for the lamp circuit (L), BLUE for the lampchanger turret-advance pulse (F), and YELLOW for the daylight control circuit (S). The negative lead shall use WHITE.

    b. Wire Type. Minor aids are typically wired with two-conductor, SO-type cable. The use of SO, SEO, and similar wire is discouraged for installation at major aids, such as solar powered lighthouses and ranges, as their long term resistance to sunlight is poor. Individual insulated conductors, suitable for outdoor installation, should be installed in rigid plastic or steel conduit, or "Liquid-flex" flexible metal conduit. Leads for the VRB-25 rotating beacon shall be installed in grounded, metallic conduit only.

6.C.4. c. Termination. Wires terminated under pressure or clamp type terminals do not require lugs, however, use of No-ox grease is recommended to prevent corrosion. Screw terminals require ring or locking spade lugs. Soldering the lugs to the wire, in addition to crimping with heavy-duty industrial crimpers, is recommended. Soldering will prevent crevice corrosion and eventual failure of the connection. If connections are not soldered, a visual inspection of all joints is required during scheduled service visits.

d. Acceptable Voltage Drop. Wire size is based on the acceptable voltage drop of the circuit. The maximum acceptable voltage drop is 0.75 volts for the "charging system," the wire run from the solar panels (or battery charger) to the battery. For minor aids, the maximum allowable voltage drop due to the wiring from the battery to the load(s) (the "power leads") is 0.10 volts. For major aids, the maximum allowable voltage drop for power leads is 0.35 volts. Table 6-2 provides conservative values for the maximum length of power cable for 12-volt installations.

Table 6-2
Maximum Length—12-volt Power Leads

Lamp Rating	Maximum Length of Power Leads (ft)				
	Major Aids				Minor
	12AWG	10AWG	8AWG	6AWG	12AWG
0.25A	350	560	900	1400	125
0.55A	160	260	410	650	55
0.77A	115	180	290	460	40
1.15A, & 1.0A	75	120	195	310	27
2.03A, & 1.9A	45	70	110	175	15
3.05A, 3.0A, & 35W	30	45	75	115	10
50W	20	35	55	85	—
75W	15	25	35	55	—
100W & 110W	10	15	25	40	—

e. 12VDC Wiring Details. Details on the wiring of internal components to an AtoN light are described in the Short Range Servicing Guide, and in the various data sheets found in Section E of this chapter.

f. Obstructions. Vertical obstructions in front of omnidirectional lanterns should be avoided. Contact COMDT (G-SEC-2A) for assistance in determining the reduction in service when obstructions are placed in front of any lantern.

6.C. 5. Wiring—120-volt AC. The AC Servicing Guide, manufacturers' manuals, and applicable Standard Configuration Drawings, provide guidance on the proper wiring of 120-volt powered AtoN lights. Instructions on the internal wiring of lights are also contained in the various data sheets found in Section E of this chapter.

a. **SAFETY WARNING. SECURE POWER TO 120-VOLT POWERED AIDS TO NAVIGATION EQUIPMENT PRIOR TO INSTALLATION OR SERVICING. CHECK TO BE SURE POWER IS OFF.**

b. Conventions. Wires are color-coded. Power leads shall use BLACK as "Hot" (120VAC), WHITE as "Neutral" and GREEN as "Equipment Ground." Internal wiring in an optical assembly uses RED for the lamp circuit (L), BLACK for "Hot", and WHITE for "Neutral."

c. Wire Type. Simple systems are typically wired with three-conductor, 12AWG, SO-type cable. The use of SO-type cable is discouraged for exposed wiring and complex systems. Individual insulated conductors, suitable for outdoor installation, should be installed in rigid plastic or steel conduit, or "Liquid-flex" flexible metal conduit.

d. Termination. Wires terminated under pressure or clamp type terminals do not require lugs, however, use of No-ox grease is recommended to prevent corrosion. Screw terminals require ring or locking spade lugs. Soldering the lugs to the wire, in addition to crimping with heavy-duty industrial crimpers, is recommended. Soldering will prevent crevice corrosion and eventual failure of the connection. If connections are not soldered, a visual inspection of all joints is required during scheduled service visits.

e. Acceptable Voltage Drop. Wire size in 120-volt systems is based on the safe amperage carrying capacity, known as "ampacity," of the leads. 12AWG wire has an adequate ampacity for standard Coast Guard 120-volt powered aids to navigation signals.

f. 120VAC Wiring Details. Details on the wiring of internal components to an aid to navigation light are described in the AC Servicing Guide, and are outlined in the various data sheets herein.

6.C. 6. Lamps.

a. 12-volt Lamps. There are three different types of marine signal lamps used in 12-volt AtoN lights; single-coil (C-8) tungsten filament lamps, coiled-coil (CC-8) tungsten filament lamps, and tungsten-halogen lamps. The orientation of the filaments is vertical for all three lamp types. Tungsten filament lamps are identified by the nominal current at rated voltage (e.g.: 0.77 amp or 0.77A for C-8 lamps/1.9A for CC-8 lamps). Tungsten-halogen lamps are identified by the nominal power consumption at rated voltage (e.g.: 50 watts or 50W). All 12-volt lamps have single-contact candelabra bases with prefocus collars. Lamps with a power consumption of 50 watts or greater must be installed in the high-wattage version of the six-place lampchanger (CG-6PHW).

b. 120-volt Lamps. The three lamps used in 120-volt aids to navigation lights are all tungsten-halogen lamps, with vertically oriented, coiled-coil (CC-8) filaments. These lamps are identified by nominal power consumption. The 1000 watt lamp has a mogul bi-post base, while the 250 watt and 150 watt lamps have dual-contact bayonet bases. The 1000 watt lamp is installed in a two-place lampchanger (CG-2P), while 250 watt and 150 watt lamps are installed in a four-place lampchanger (CG-4P).

c. Handling of Lamps. Lamp envelopes should be protected from scratches, and handled as little as possible. All lamps should be cleaned after installation, by wiping the envelope with a medicinal swab or a clean cloth wetted with denatured alcohol. **Tungsten-halogen lamps are designed to operate at high temperature and pressure, and are subject to explosive failure if the envelope is contaminated with oil or dirt**. Tungsten-halogen lamps remain very hot for several minutes after power is secured.

d. Selection of Lamps. The data sheets for the lanterns and beacons, found in Section E of this chapter, describe which lamps may be used with standard lanterns and beacons. The intensities provided by the various lens/lamp combinations are also detailed in the Visual Signal Design Manual.

7. Mounting and Leveling of Fixed Aids. A complete mounting hardware kit for all omnidirectional lanterns, and the VRB-25 and FA-251-AC rotating beacons, is comprised of three lengths of threaded rod (½" or ⅜"—13 UNC x 4½" long), 12 hex nuts, six flat washers, and six split (locking) washers. Six self-locking (Nyloc) nuts may be used in place of 6 of the hex nuts and the split washers. Bolts may be used in place of the threaded rods and three of the hex nuts.

The RL14 and RL24 range lanterns require three ⅜" bolts, 3 inches in length, each with a hex nut, flat washer and split washer, or a self-locking nut and flat washer.

6.C.7. (cont'd) Mounting hardware for the DCB24 and DCB224 rotating beacons includes three ¾" cap screws, each with a flat washer and split washer. These items are provided with the beacons.

Use only three rods/bolts for mounting a light, even if the lantern or beacon has four bolt holes. This is to prevent breaking the casting of the lantern. Specific instructions for mounting lanterns and beacons are detailed in the respective data sheets, found in Section E of this chapter, and may also be found in the appropriate Servicing Guides and manufacturers' manuals. Mounting hardware may be procured locally and shall be made of stainless steel.

a. Omnidirectional Lanterns. The 155mm and 200mm buoy lanterns, and the 250mm and 300mm medium intensity lanterns all have a 7⅞" (200mm) bolt circle. The 155mm and 300mm lantern have three bolt holes equally spaced around the bolt circle. The 250mm lantern has four bolt holes. Older 200mm lanterns have four slots for mounting hardware, while the newer version has six slots, which allow for three or four-hole mounting. **Only three bolt holes shall be used in all cases**.

b. Rotating Beacons. The VRB-25 and FA-251-AC rotating beacons both have a 7⅞" (200mm) bolt circle. The VRB-25 beacon has three bolt holes, which have acetyl inserts to protect the beacon and mounting rods from galvanic corrosion. Do not remove these inserts. Replacements may be commercially purchased or fabricated locally. The FA-251-AC beacon has four bolt holes equally spaced about the bolt circle. **Only three of the four bolt holes shall be used to mount the beacon**. The DCB24 and DCB224 rotating beacons have three equally spaced legs that are centered on a 21½ inch (546mm) bolt circle. The beacons are mounted directly to the deck by the ¾" cap screws that are provided.

c. Range Lanterns. The RL14 and RL24 range lanterns have three leveling bushings equally spaced on a 14¾" (375mm) bolt circle. The bushings have clearance for ½" or ⅜" bolts. The RL14 range lantern also has tilt and elevation adjustment levels mounted on top of the lantern bezel assembly. The RL24 range lantern does not have built-in levels.

8. <u>Lamp Selection and Focusing</u>.

a. Lamp Selection. There are some restrictions on the use of certain lamps in various optics. Some of these restrictions are due to physical limitations; for example, there is insufficient clearance in the 155mm lantern to permit free rotation of the CG-6P lampchanger when outfitted with 12-volt, 3.05 amp lamps. Other restrictions are due to concerns about optical performance. Specific restrictions on lamp selection are discussed in the individual data sheets for the various optics.

6.C.8. b. Focusing Requirements. Vertical or horizontal displacement of the lamp filament center from the true focal point of an optic will affect the projected beam. Depending on the type of optic, these variations will result in displacement of the beam up or down from the intended horizontal plane, or in a wider, less intense beam. To insure that the signal provided to the mariner meets the rated intensity for the lens/lamp combination selected, it is necessary to place the lamp filament at the focal point of the optic within prescribed tolerances.

c. Prefocused Optics. Certain optics are described as "prefocused." That is, the manufacturing tolerances of the optic and the various components that are used to produce an AtoN signal are such that no adjustment should be necessary to ensure that a lamp filament is situated at the focal point of the optic, within the prescribed tolerance for that specific optic. The following optics are considered to be prefocused optics:

- 155mm lantern;
- 200mm lantern;
- RL14 range lantern; and

While these optics do not provide for adjustment of the lamp filament position, the focus of the optic should be checked from time to time to ensure that none of the internal components, such as the lampchanger bracket, or lampchanger, have been damaged. Procedures for checking the focus are outlined in the respective data sheets for these optics.

d. Optics Not Requiring Focusing. The following optics have adjustable focusing, but do not normally require focusing:

- DCB24 and DCB224 rotating beacons; and
- RL24 range lantern.

These optics are focused during manufacture. No further adjustment is required, unless the optical assembly is changed or taken apart for some reason (such as replacement of the lampchanger). Focusing adjustments are NOT required as part of normal lamp replacement.

e. Optics Requiring Focusing. The following optics require focusing whenever the optic is relamped:

- 250mm lantern;
- 300mm lantern;
- VRB-25 rotating beacon; and
- FA-251-AC rotating beacon.

Procedures for adjusting the focus are outlined in the respective data sheets and manufacturers' manuals for these optics.

6.C. 9. Lantern Requirements. When used by itself, the word *lantern* shall be understood to mean the structure at the top of a lighthouse that surrounds and protects the optic.

a. Ventilation. Lanterns must have adequate rain-proof vents to equalize the inside and outside temperatures. Failure to maintain working vents may result in condensation on the lantern panes, severely reducing the light intensity. This requirement is especially true in lighthouses with 12-volt signals, which do not emit enough excess heat to evaporate condensation that may form.

b. Prevention of False Flashes. False flashes occur when a beam from a rotating beacon is reflected off a lantern pane, and is emitted out the far side of the lantern. It is especially prevalent in lighthouses outfitted with the DCB24 rotating beacon, or when the DCB224 or VRB-25 rotating beacons are used to produce group rhythms. Where practicable, lantern panes should be installed with the top edge slanted out ⅝" per foot of height beyond the bottom edge (approximately 3 degrees from vertical). For lanterns that cannot readily be modified, retractable shades may be hung in the lantern. The shades shall extend radial from the optic to the astragals supporting the lantern panes.

c. Control of Ambiguous Color Sectors. Producing colored sectors by use of colored lantern panes will result in an ambiguous zone between white and colored sectors. The angular size of the zone is proportional to the ratio of the emitting surface of the light to the distance between the emitting surface and the color filter. In general, colored sectors should not be installed at aids with rotating beacons due to the relatively large ambiguity zone created. Prior to replacing an omnidirectional lantern with a rotating beacon at aids with colored sectors, the impact of an enlarged ambiguity zone must be evaluated. Existing colored sectors at aids with rotating beacons may be retained.

If a DCB224 rotating beacon is used at an aid with colored sectors, the two beams shall be separated by 180 degrees and point radial outward from the axis of rotation, or the two beams shall be separated by 90 degrees, as shown in figure 6-6.

d. Colored Lantern Panes. UV stabilized, transparent lexan or plexiglass (acrylic) may be used to replace colored glass lantern panes. Plexiglass color numbers (Rohn & Haas Company) that are suitable for use are 2124 (green), 2226 (red), and 2129 (red). Use off-the-shelf transparent cast sheets. Sheeting should be rated by the manufacturer to have 20 to 30 percent transmission of incandescent light. Due to the difficulty in obtaining red lantern panes, COMDT (G-SEC) has stocked 4 by 8 foot

6.C.9.d. (cont'd) sheets of red cast acrylic in the supply fund at the Engineering Logistics Center. Sheets may be obtained by MILSTRIP using stock number 9330-01-429-6103.

D. Inspection, Maintenance and Repair on Station.

1. Inspection and Maintenance Schedule. The inspection and maintenance schedule for AtoN light signals will vary from semi-annual to biennial, depending on the equipment in service. Service intervals for lighthouse equipment are established in COMDTINST M16500.10, *Lighthouse Preventive Maintenance System Manual* (PMS Manual). A copy of the PMS Manual, tailored to the equipment at a given aid, shall be maintained by the primary servicing unit for every aid that falls under the manual's guidelines. The AtoN Admin Manual establishes a maximum service interval of two years for minor aids. The limiting item to allowing a two-year service interval at minor aids and ranges is usually lamplife.

a.. Lighthouses. Follow the guidelines prescribed for the installed equipment, as set forth in the PMS Manual.

b. Fixed Aids—Minor. The servicing interval of a fixed, minor aid shall not be more than two years, or two-thirds the expected lamplife. The Aids to Navigation Servicing Interval Flowchart (AtoN SIF), used to determine the allowable servicing interval of existing aids, is provided in Chapter 7 of the AtoN Admin Manual. The limiting interval based on lamplife may also be calculated. Lamplife is calculated by multiplying the number of lamps in an optic by the rated lamplife for a single lamp, and dividing the result by the duty cycle of the rhythm. This yields the expected hours of operation for the lamps. Take two-thirds of this value, and divide by the number of hours of operation per year to arrive at the maximum allowable service interval (in years), based on lamplife alone. For nighttime-only operation, use a value of 4,400 hours per year. For day and night operation, use 8,800 hours per year.

Example 1: An optic is outfitted with a CG-6P lampchanger and 12-volt marine signal lamps, and displays a Fl 2.5 (0.3) rhythm. The aid is daylight controlled. What is the maximum allowable service interval?

- 6 lamps X 500 hours/lamp = 3,000 hours of lamplife.
- 3,000 hours ÷ 0.12 = 25,000 hours of operation;
- 25,000 hours X 2/3 = 16,667 hours (for calculation of service interval).
- 16,667 hours ÷ 4,400 hours per year = 3.8 years or 45 months.

Thus, for example 1, the maximum allowable service interval (due to lamplife) is 45 months. The scheduled service interval for the aid shall be every two years.

6.D.1.b. (cont'd) Example 2: An optic is outfitted with a CG-4P lampchanger and 120-volt 150 watt lamps, and displays an Oc 4 rhythm. The aid burns both day and night. What is the maximum allowable service interval?

- 4 lamps X 2000 hours/lamp = 8,000 hours of lamplife.
- 8000 hours ÷ 0.75 = 10,667 hours of operation;
- 10,670 hours X 2/3 = 7,100 hours (for calculation of service interval).
- 7,100 hours ÷ 8,800 hours per year = 0.8 years or about 9 months.

Thus, for example 2, the maximum allowable service interval (due to lamplife) is 9 months. The actual service interval for the aid shall not exceed 9 months.

c. Buoys. The limiting item for establishing the maximum possible servicing interval of a lighted buoy will be either the mooring chain or lamplife. Chapter 2 of this manual describes the policy regarding calculation of the mooring chain service interval. The servicing unit must also evaluate the expected lamplife for the aid, to ensure that the aid will not exceed the maximum allowable interval for lamplife prior to scheduled servicing of the mooring chain. The procedure for evaluating the maximum service interval of lamps for fixed, minor aids shall be followed for buoy lights. Note, the arduous conditions of service on buoys may degrade lamplife. The calculated lamplife may exceed the actual service interval provided by the lamps. Calculated service intervals should be evaluated against historic records, as outlined in the AtoN SIF (see Chapter 7 of the AtoN Admin Manual), before being used as justification for extending the service interval.

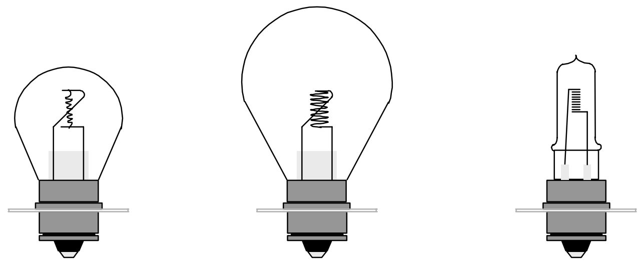
d. Ranges. The maximum allowable service interval, due to lamplife, shall be calculated in the same manner as for fixed, minor aids, except that the service interval may be as much as 75% of the rated lamp life. The service interval for the aid shall be the lesser of two years or the maximum allowable service interval due to lamplife. For day/night ranges, the maximum allowable service interval for both the daytime and the nighttime optics must be computed separately. Use 4,400 hours per year for both the daytime and nighttime optics. The lesser of the two solutions will be used to establish the service interval of all the optics for the range.

Note, tungsten-halogen lamps and the CC-8 lamps provide greater service life than the C-8 marine signal lamps.

2. Maintenance and Repair Guidelines. Detailed information on the maintenance and repair of standard equipment is provided in the Servicing Guides and in the manufacturers' manuals. Questions concerning specific maintenance requirements may be directed to the supporting Group Office, the District Aids-to-Navigation Office, National AtoN School staff, or COMDT (G-SEC).

E. General Description Data Sheets.

12-Volt Marine Signal Lamps



Function. 12-volt marine signal lamps are used with a variety of omnidirectional lanterns, as well as the RL14 range lantern and the VRB-25 rotating beacon. There are three types of 12-volt marine signal lamps: tungsten lamps with C-8 filaments (vertical coil); tungsten lamps with CC-8 filaments (vertical coiled-coil); and tungsten-halogen lamps with C-8 filaments. The C-8 tungsten filament lamps are normally used in omnidirectional lanterns at both fixed and floating aids, to provide a light with a nominal range of less than 9nm. **If an RL14 range lantern is outfitted with these lamps, a spread lens must also be installed**. The CC-8 tungsten filament lamps are primarily used in the RL14 range lanterns; use of these lamps does not require a spread lens. Tungsten-halogen lamps may be used in the RL14 range lantern (spread lenses are not required) and in the VRB-25 rotating beacon. Due to the relative shortness of their filaments, the CC-8 tungsten filament lamps and tungsten-halogen lamps (except the 100 and 110 watt lamps) are not authorized for use in omnidirectional lanterns.

Features.

- Omnidirectional light output in the horizontal plane.
- C-8 or CC-8 incandescent filament (vertical orientation).
- Minimum 500-hr life expectancy when burned fixed.
- Prefocus collar, for accurate alignment of lamp in lampchanger.
- Nickel-plated brass, single-contact base.

Related Equipment. The lamps are used with a CG-6P lampchanger and either a CG-181/493 flasher or a SAC-II. The 155 and 200mm omnidirectional lanterns may only be equipped with C-8 tungsten filament lamps, up to and including the 2.03 amp lamp. The 250 and 300mm lanterns may only be equipped with C-8 tungsten filament lamps or the 100 or 110watt tungsten-halogen lamps. The RL14 range lantern may be equipped with C-8 tungsten filament lamps (with spread lens), CC-8 tungsten filament lamps (with or without spread lenses), and with C-8 tungsten-halogen lamps (with or without spread lenses). The VRB-25 rotating beacon may be equipped with any 12-volt lamp, however optimum performance is achieved with tungsten-halogen lamps.

Data Sheet 6-E(1). 12-Volt Marine Signal Lamps

6.E.

Additional Data. Technical specifications for 12-volt lamps are given in specification number G-ECV-487. The general configuration and dimensions of 12-volt marine signal lamps and the prefocus collar are illustrated in figure 6-1. Lamps are stocked at Engineering Logistics Center, Baltimore. Table 6-3 describes the operational data for the lamps, and provides stock numbers for ordering through the national stock system. Marine signal lamps are sold in boxes of ten.

Table 6-3A: C-8 Tungsten Filament Lamps

Lamp Rating (Amps)	Lamp Life (Hours)	Output (Lumens)	Minimum On Time (Seconds)	Bulb Type	National Stock Number
0.25	500	30	0.30	S-8	6240-01-032-5034
0.55	500	70	0.30	S-8	6240-01-199-2374
0.77	500	120	0.30	S-8	6240-01-186-2033
1.15	500	180	0.30	S-8	6240-01-186-2032
2.03	500	380	0.30	S-8	6240-00-262-8845
3.05	500	600	0.40	S-11	6240-00-262-8840

Table 6-3B: CC-8 Tungsten Filament Lamps

Lamp Rating (Amps)	Lamp Life (Hours)	Output (Lumens)	Minimum On Time (Seconds)	Bulb Type	Activity Control Number
1.0	1000	145	0.30	S-11	6240-01-420-4236
1.9	1000	390	0.30	S-11	6240-01-420-4240
3.0	1000	600	0.40	S-11	6240-01-420-4246

Note: Recommended for use in the RL14 range lantern.

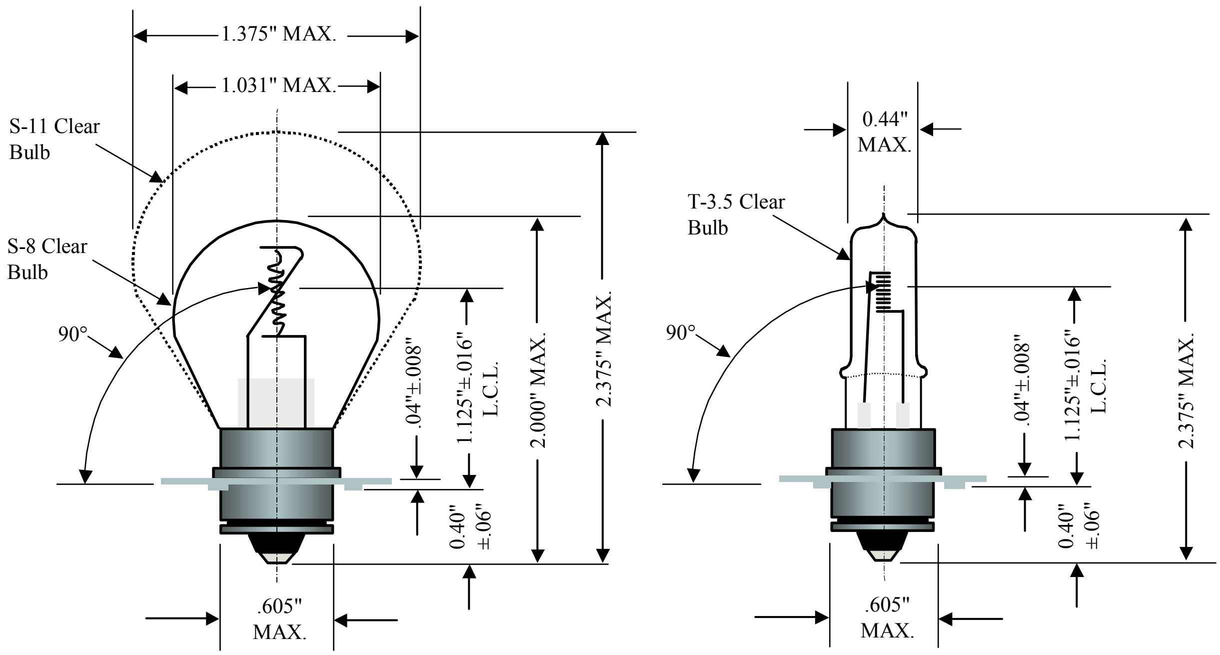
Table 6-3C: C-8 Tungsten-Halogen Lamps

Lamp Rating (Watts)	Lamp Life (Hours)	Output (Lumens)	Minimum On Time (Seconds)	Bulb Type	National Stock Number
35	2000	630	0.40	T-4	6240-01-487-7863
50	2000	1000	0.50	T-4	6240-01-487-7880
75	2000	1600	0.60	T-4	6240-01-487-7892
100	2000	2400	1.00	T-4	6240-01-487-7898
110	600	2600	1.00	T-4	6240-01-374-5113

Note: Recommended for use in the RL14 range lantern and VRB-25 rotating beacon.

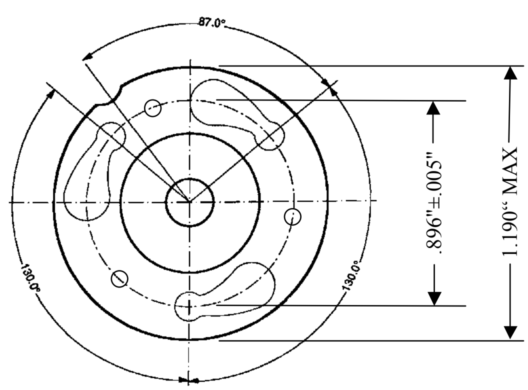
Data Sheet 6-E(1). (cont'd).

6.E.



S-8 and S-11 Bulbs
(Tungsten Filament)

T-3.5 Bulbs
(Tungsten-Halogen)



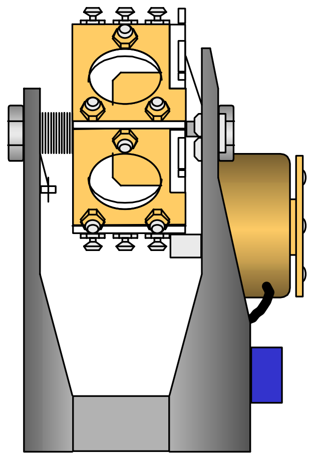
Single-Contact Candelabra Base with Prefocus Collar

Figure 6-1. Dimensions of 12-volt lamps and base.

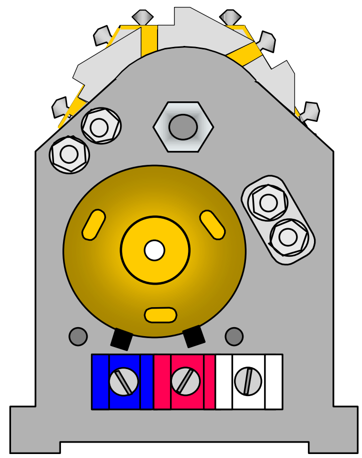
Data Sheet 6-E(1). (cont'd).

6.E.

12VDC Lampchanger (CG-6P & CG-6PHW)



End View



Side View

Function. The CG-6P and CG-6PHW lampchangers support six 12-volt lamps with the filament of the burning lamp at the focal point of the lantern. A spare lamp rotates to the operating position when the burning lamp fails. The lampchangers do not sense lamp failure; relamping is triggered by a pulse from the CG-181, CG-493 or CG-481 flasher, or a Solar Aid Controller II (SAC II). The CG-6P lampchanger will safely operate lamps with a current draw of 3.05 amps or less (including 35-watt tungsten-halogen lamps). The CG-6PHW lampchanger is used to operate lamps rated at 50 watts or greater. The lampchangers are similar in appearance, with the CG-6PHW lampchanger frame painted red. The pins on the turret, which the prefocus collar snaps onto, are spaced so that the lamp can only be fitted in one orientation. The notch on the lamp collar is aligned between the two pins on the turret that are spaced closer together.

Features.

- Holds six 12-volt marine signal lamps in a spring-wound turret.
- Three color-coded terminals, for wiring to a 12VDC flasher.
- Accurately places the lamp in the operating position at the focal point of an optic.
- Corrosion resistant.
- Shadow-free, to 52 degrees below the horizontal (focal) plane.
- Designed to maintain continuous circuit, even under the shock and vibration encountered on minor aids to navigation.
- Operates in both horizontal and vertical orientations.
- 56-ohm resistor parallel with the sixth lamp position, to suppress the flasher from sending a pulse across the “F” terminal in the event all six lamps fail.

Data Sheet 6-E(2). 12VDC Lampchanger (CG-6P & CG-6PHW).

6.E.

Electrical and Mechanical Characteristics.

- Input voltage ....10 to 14VDC
- Maximum current...............................4.0 amps/10.0 amps (HW)
- Maximum lamp circuit resistance......0.03 ohms
- Solenoid coil resistance......................15 ohms
- Solenoid coil voltage..........................8 to 18 Vdc
- Solenoid coil pulse duration...............0.25 to 5.0 sec
- Ambient temperature range................0 to +125 degrees F
- Lamp positioning tolerance:
  Horizontally ....±0.031 in.
  Vertically...±0.010 in.

Related Equipment. The CG-6P lampchanger is used with 12-volt marine signal lamps with a current draw of up to 3.05 amps, and the CG-181/493 flasher or SAC II. The CG-6PHW is used with 12-volt tungsten-halogen lamps rated at 50 watts or more, and the CG-481 (high-wattage) flasher or SAC II. All 12-volt powered optics may be equipped with the CG-6P lampchanger. They shall be equipped with the CG-6PHW lampchanger when outfitted with 12-volt tungsten-halogen lamps rated at 50 watts or more.

Additional Data. Technical specifications for the CG-6P lampchanger are given in G-ECV Specification 195, and for the CG-6PHW lampchanger in G-SEC Specification 478. The dimensions of the CG-6P and CG-6PHW lampchangers are the same (see figure 6-2). The lampchangers each weigh approximately 2.5 lbs. The CG-6P (NSN 6250-01-030-3485) and CG-6PHW (NSN 6250-01-374-5127) lampchangers are stocked at the Engineering Logistics Center.

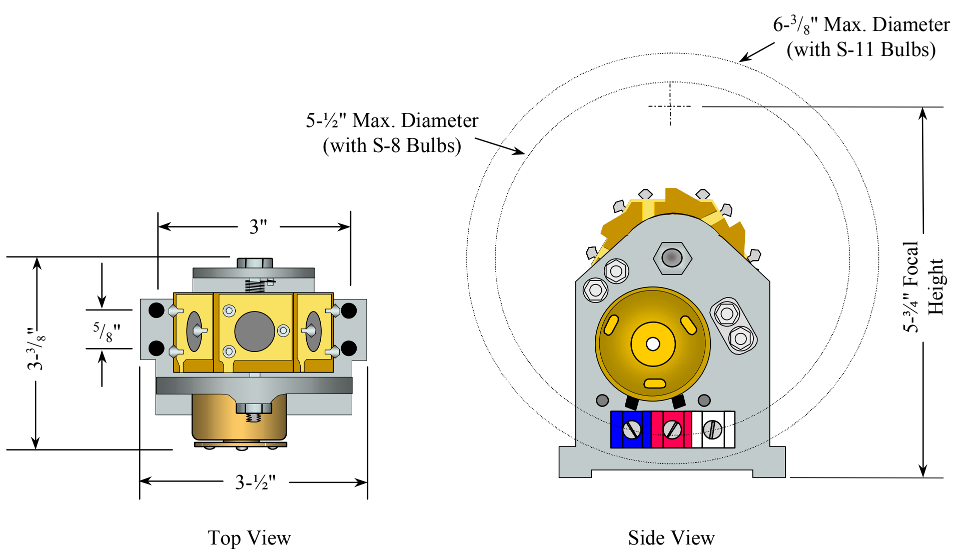
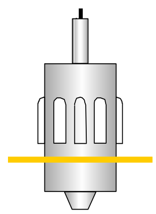


Figure 6-2. Dimensions of the CG-6P and CG-6PWH Lampchangers

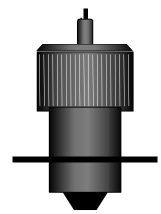
Data Sheet 6-E(2). (cont'd).

6.E.

12-Volt Focus Fixture



Standard
Focus Fixture



Precision
Focus Fixture

Function. Focus fixtures are used to assist in the focusing of optics by placing an item with a defined height in the six-place lampchanger within an adjustable optic. There are two 12-volt focus fixtures; a commercial item used with the 155mm, 200mm, 250mm and 300mm marine signal lanterns, and a precision fixture for use with the VRB-25 rotating beacon. A precision focus fixture is provided with each VRB-25 rotating beacon as part of the original provisioning. The focus fixtures are manufactured with the same prefocus collar as the 12-volt lamps, to ensure proper alignment in the lampchanger.

Related Equipment. 12-volt focus fixtures are used with the CG-6P or CG-6PHW lampchanger to assist in adjusting the focus of the marine signal lanterns and the VRB-25 rotating beacon.

Additional Data. Purchase of a focus fixture for use with the 155mm, 200mm, 250mm and 300mm marine signal lanterns may be made as a Commercial-Off-The-Shelf (COTS) procurement from Tideland Signal Corporation, P.O. Box 52430, Houston, Texas, 77052, (713) 681-6101. The part number for the item is P/N 630.1022-01. This focus fixture may also be used with the VRB-25 rotating beacon, although it is not as precise as the focus fixture provided with that beacon.

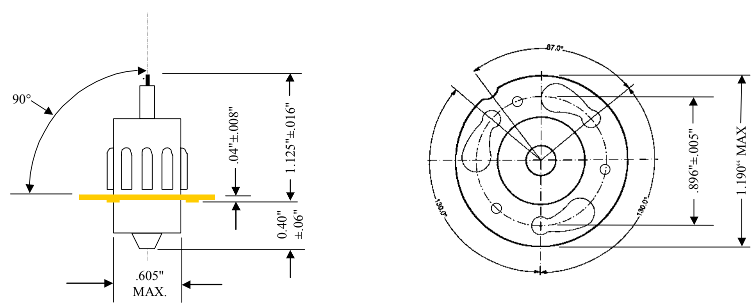
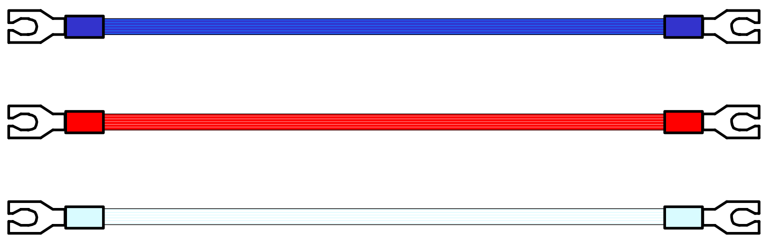


Figure 6-3. Dimensions of 12-volt lamp focus fixture.

Data Sheet 6-E(3). 12-Volt Focus Fixture.

6.E.

12VDC Wiring Kit (WK-681)



Function. The WK-681 wiring kit is used to electrically connect the CG-6P or CG-6PHW lampchanger to the CG-181/493 or CG-481 flasher. The WK-681 wiring kit comes with three color-coded leads (one each blue, red, and white).

Features.

- Three color-coded leads.
- Single-conductor copper wire.
- Crimped and soldered spring spade lug terminals.

Dimensions.

- Wire size ....#16 AWG
- Lug size......................#14 to 16 AWG
- Wire length.................6-1/2 ± 1/4 in.

Additional Data. An installation diagram is included with the three leads in the WK-681 wiring kit. Technical specifications are provided in G-ECV Specification 261. The WK-681 wiring kit is stocked at the Engineering Logistics Center (NSN 6230-01-040-6848).

Data Sheet 6-E(4). 12VDC Wiring kit (WK-681).

12-Volt Daylight Control (DLC)

Type R (Internal)   Type L (External)

<u>Function</u>. A daylight control is a photoelectric cell that changes resistance as the ambient light level changes. The type of cells used by the Coast Guard have an increasing resistance under conditions of decreasing illumination. When connected to CG-181/493 or CG-481 flasher, or the Solar Aid Controller II (SAC II), the changing resistance of the daylight control activates an on-off switch that turns the light on in the evening and off in the morning. The operating parameters for 12-volt daylight controls were selected so that lighted aids in a given waterway, regardless of the lens color, will switch on at sunset and off at sunrise.

<u>Features</u>.

- Two classes; one class is mounted inside the lantern, the other is mounted externally.
- Total of three types; two for internal mounting, one for external mounting.
- Color-coded cases.
- Hermetically sealed.
- Low cost, non-repairable items.

<u>Related Equipment</u>. For minor aids, a 12-volt daylight control is connected to a CG-181/493 or CG-481 flasher in the optic to be controlled. For solar-powered major aids, the externally mounted Type L daylight control is used with a SAC II, described in Chapter 9. The Type L daylight control is also used with the FLAC-300 120VAC Flasher (see Data Sheet 6-E(12)), the AC Flash Controller and the Audio-Visual Controller, described in Chapter 8, to control 120-volt aids. Table 6-4 matches the various lens types with the appropriate daylight control. A Type L daylight control must be used when a fixed-on rhythm is used.

Data Sheet 6-E(5). 12-Volt Daylight Control (DLC).

6.E.

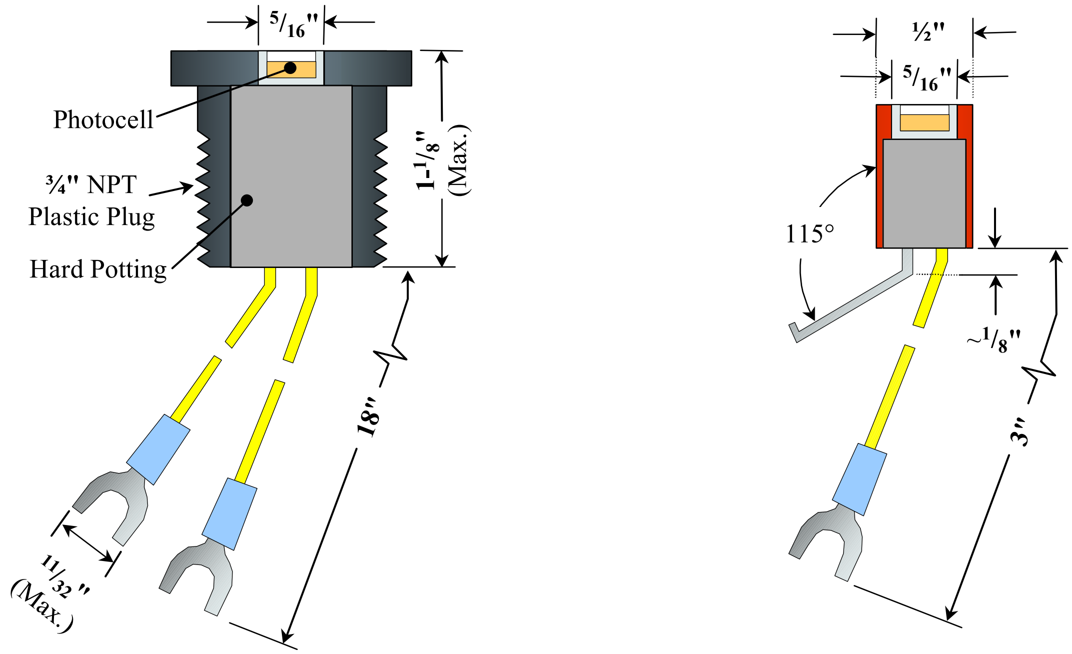
Additional Data. Technical specifications for 12-volt daylight controls are given in G-ECV Specification 234. Figure 6-4 provides the dimensions of the external (Type L) and internal (Types C and R) daylight controls. Standard 12-volt daylight controls are stocked at Engineering Logistics Center, Baltimore.

Table 6-4

Daylight Control Specifications and Applicable Stock Numbers

Sensor Type	Color	Resistance (ohms)*	Mounting	Lens Type	Lens Color	National Stock Number (NSN)
C	White	129K	Internal	Any	Clear/Yellow	5980-01-031-8858
R	Red	49K	Internal	Acrylic	Red/Green	5980-01-045-5470
L	Metal	129K	External	Any	All	5980-01-034-6058

*When illuminated by a tungsten source providing an illuminance of 2 ft-cd.



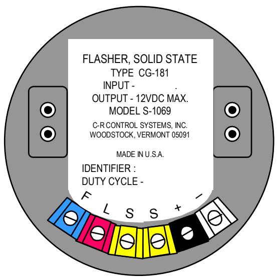
Type L (External)

Types C & R (Internal)

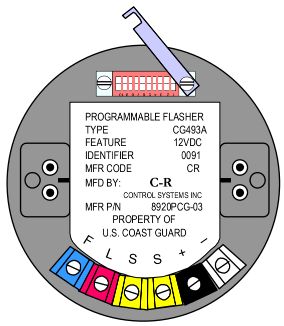
Figure 6-4. Dimensions of 12-volt Daylight Controls

Data Sheet 6-E(5). (cont'd).

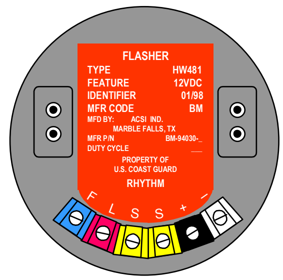
12VDC Flasher (CG-181, CG-493 & CG-481)



CG-181 Flasher
(C-R Control)



CG-493 Programmable
Flasher
(C-R Control)



CG-481 HW Flasher
(ACSI Ind.)

<u>Function</u>. The CG-181, CG-493 and CG-481 flashers time-code (flash) and regulate the direct current voltage to 12-volt marine signal lamps. The flasher senses failure of the operating lamp and provides a pulse (known as the "F" pulse) to energize the solenoid on the CG-6P or CG-6PHW lampchanger, allowing the turret to index to a new lamp. The CG-493 programmable flasher is similar to the CG-181 except the programmability. With CG-493, users can select a flash rhythm by using the switch mounted on the flasher. When a daylight control is connected to the flasher, power to the lamp is turned off during daylight hours. The CG-181 and CG-493 flashers will safely operate lamps with a current draw of 3.05 amps or less (including the 35-watt tungsten-halogen lamp). The CG-481 flasher is used to operate lamps rated at 50 watts or greater. CG-181's will be phased out and replaced by CG-493's when current supplies are exhausted.

<u>Features</u>.

- Solid-state electrical components.
- Short circuit protection.
- Reverse polarity protection.
- All standard Coast Guard flash rhythms are available (nonadjustable).
- CG-493 flashers can be programmed to flash all standard Coast Guard rhythms.
- Color-coded terminals, for wiring to lampchanger, incoming power, and daylight control.
- Watertight container, potted to protect internal electronics package.
- Low cost, non-repairable item.

Data Sheet 6-E(6). 12VDC Flasher (CG-181, CG-493 & CG-481).

Electrical and Mechanical Characteristics.

- Input voltage ....10 to 18VDC
- Output voltage*......................9.25 to 12.2VDC
- Output current ....0.25 to 4.0 amps (CG-181/CG-493)
  ....0.25 to 10.0 amps (CG-481)
- Ambient temperature range....0 to +125 degrees F
- Timing tolerance ....±5 percent

*The output voltage is specified to be between 11.66 and 12.20VDC, or to no less than 0.75 volts below the input voltage (for input voltages between 10.0 and 12.4 volts).

Related Equipment. The CG-181 or CG-493 flasher is used with a CG-6P lampchanger, WK-681 wiring kit, 12-volt lamps and a daylight control, to outfit any of the omnidirectional optics, the VRB-25 rotating beacon, or the RL14 range lantern. The CG-481 (high-wattage) flasher is used with the CG-6PHW lampchanger, WK-681 wiring kit, 12-volt tungsten-halogen lamps (50 watts or greater) and a daylight control, to outfit the 250 or 300mm marine signal lanterns (100 or 110 watt lamps only), the VRB-25 rotating beacon, or the RL14 range lantern. A CG-181/493 flasher is used in the AC Flash Controller and the Audio-Visual Controller (see Chapter 8).

Wiring—Standard. Brackets are used to secure the lampchanger/flasher assembly in the focal position of the lantern. The type of bracket will vary from lantern to lantern. (Procedures for mounting the lampchanger/flasher assembly into an optic are described in the appropriate data sheet for the optic.) All brackets are sandwiched between the lampchanger and the flasher. The basic procedures for wiring the lampchanger and flasher together are illustrated below:

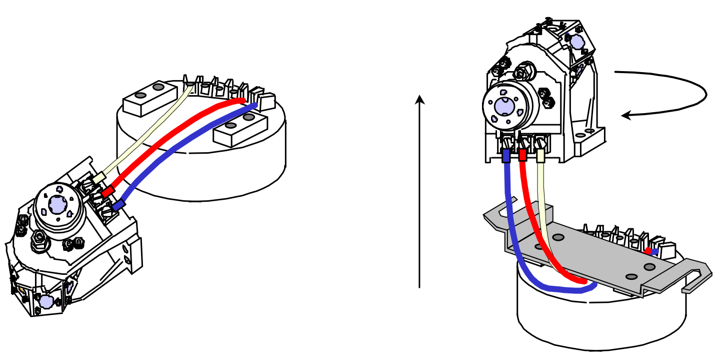


Figure 6-5. Wiring Procedures

(1) If a CG-493 is used, set the flash rhythm by turning the knob (ACSI) or arranging the DIP switches (C-R) to the desired setting.
(2) Lay a CG-6P/CG-6PHW lampchanger behind a CG-181/493/CG-481 flasher, with the terminals facing up.

Data Sheet 6-E(6). (cont'd).

6E.

(3) Install a WK-681 wiring kit to the lampchanger by pushing the spring lugs under the terminal screws. Tighten the terminal screws firmly. (Note: the wires are color-coded to match the color-coding of the lampchanger terminals.)

(4) Run the wires across the flasher and install the other end of the WK-681 wiring kit to the flasher terminals *from the inside*.

(5) Place the bracket over the flasher so the mounting holes are aligned. The appropriate brackets are identified in the data sheets for the individual optics. (Note: the wires must pass through the bracket used for the 250mm marine signal lantern. Wire the flasher with the bracket already on the flasher.)

(6) Turn the lampchanger 180 degrees as it is placed over the bracket and flasher (the terminals will be on the opposite side of the mounting bracket). Align the mounting holes.

(7) Secure the lampchanger to the flasher with four 1-inch long 10-32 screws.

(8) Install the proper internally mounted daylight control (if used) to the two yellow “S” terminals on the flasher. The daylight control housing should go next to the “+” terminal.

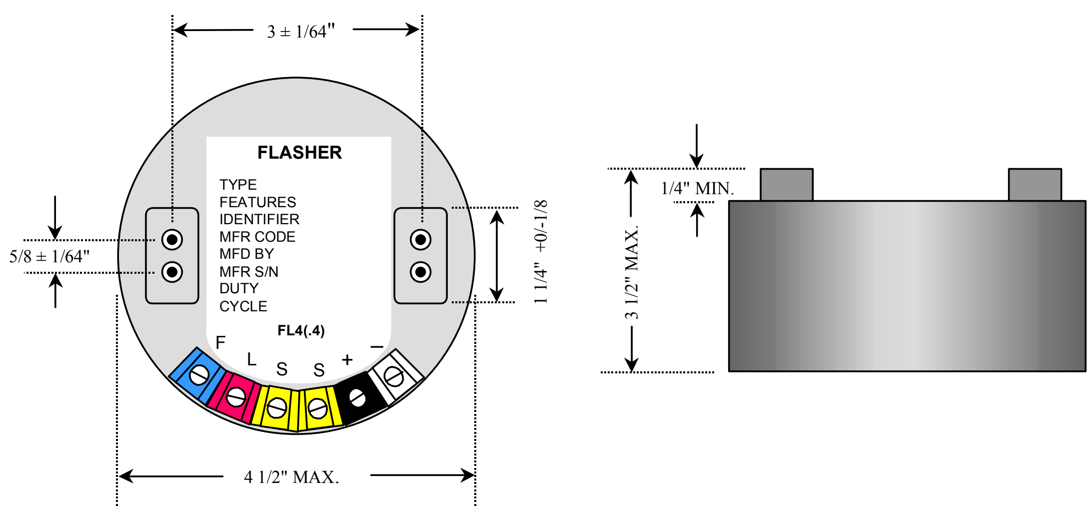


Figure 6-6. Dimensions of the CG-181, CG-493 & CG-481 Flashers.

Data Sheet 6-E(6). (cont’d).

Wiring—Synchronized. Special “master/slave” flashers allow for synchronization of the characteristic displayed by multiple optics. The optic assemblies may have a common or separate power supplies. Figure 6-7 illustrates the wiring diagram for synchronized lights.

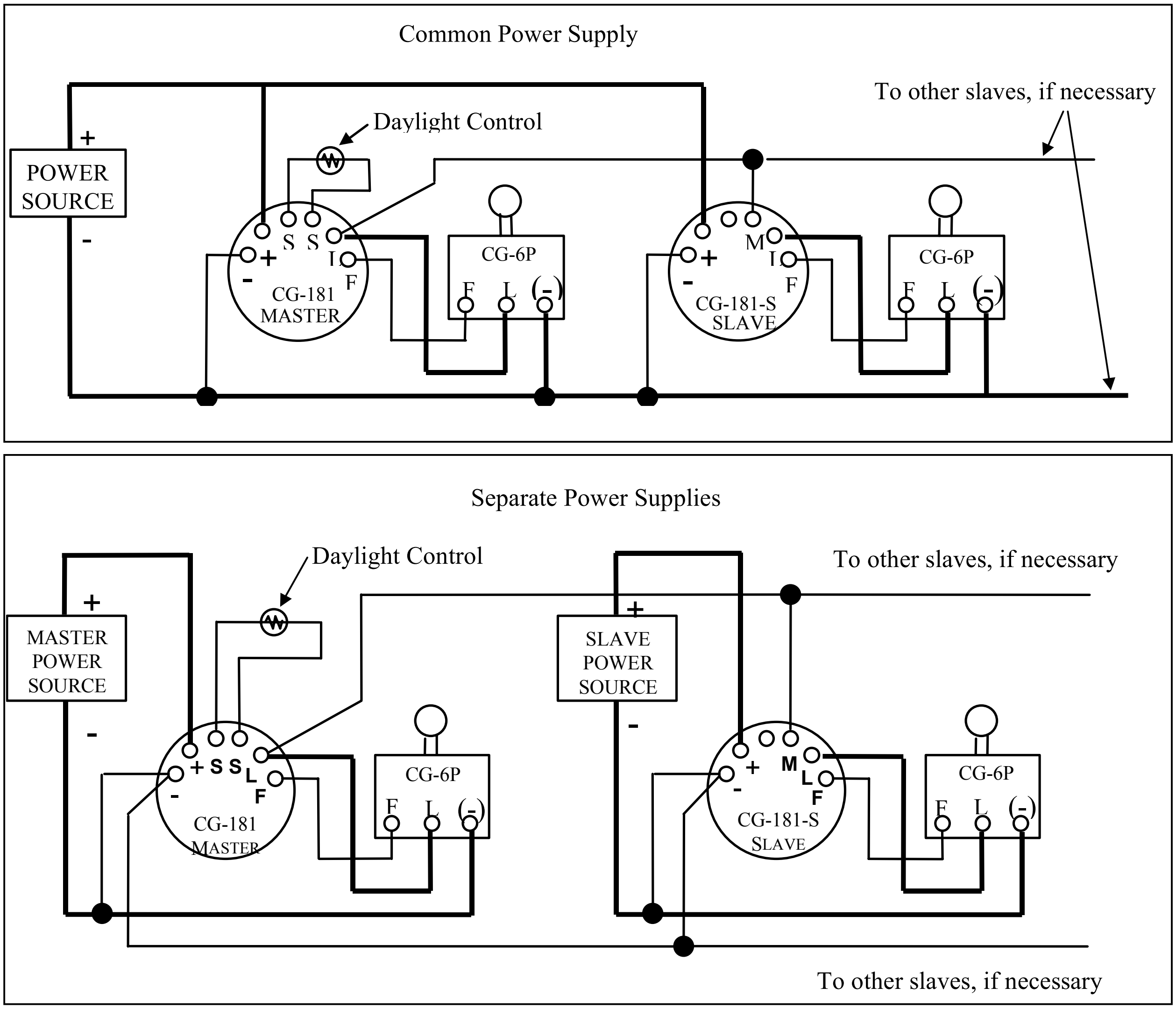


Figure 6-7. Wiring diagram for synchronized lights (common and separate power supplies)

Additional Data. Technical specifications for the CG-181, CG-493 and CG-481 flashers are provided in G-SEC Specification 181, Specification 493 and Specification 481, respectively. All flashers are stocked at the Engineering Logistics Center. The CG-481 flasher looks substantially like the CG-181 flasher, the main visual difference being that the CG-481 flasher has a red label, while the label on the CG-181 flasher is either black with white letters, or white with black letters. Figure 6-6 provides the dimensions of the flashers. Special rhythm flashers and master/slave flashers (standard and high-wattage versions) may be purchased directly from approved manufacturers. A list of approved manufacturers is available from COMDT (G-SEC).

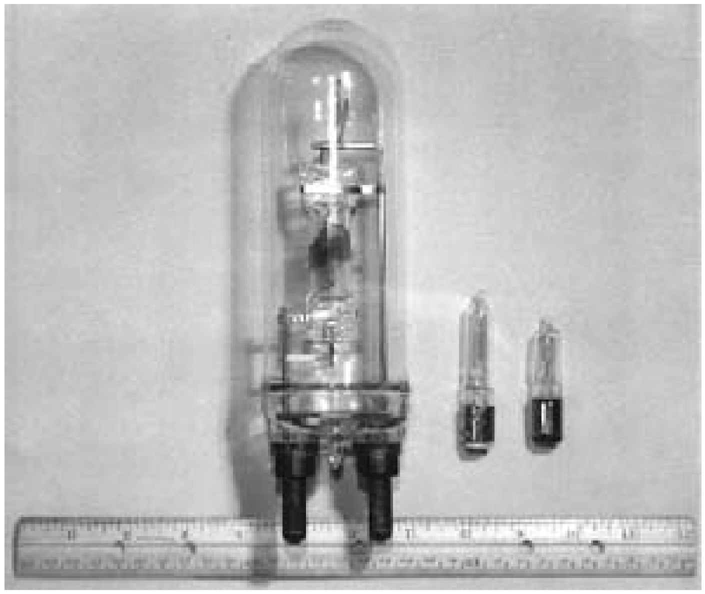
Data Sheet 6-E(6). (cont’d).

Table 6-5
Standard Flash Rhythms

Code	Type	National Stock Number	Timing Sequence (on/off) in sec.	Duty Cycle
FL6(0.6)	CG-181*	5945-00-101-9643	0.60/5.40	0.10
FL6(1)	CG-481	5945-01-GL3-5359	1.00/5.00	0.17
FL4(0.4)	CG-181*	5945-00-007-7942	0.40/3.60	0.10
FL4(1)	CG-481*	5945-01-GL3-5358	1.00/3.00	0.25
FL2.5(0.3)	CG-181*	5945-00-007-7941	0.30/2.20	0.12
FL2.5(1)	CG-181*	5945-01-GL3-6031	1.00/1.50	0.40
	CG-481	5945-01-GL3-5357		
Q	CG-181*	5945-00-101-9641	0.30/0.70	0.30
FL(2) 5	CG-181*	5945-00-007-7946	0.40/0/60/0/40/3.60	0.16
FL(2) 6	CG-181*	5945-00-101-9434	1.00/1.00/1.00/3.00	0.33
FL(2+1) 6	CG-181*	5945-01-141-8159	0.30/0.40/0.30/1.20/0.30/3.50	0.15
Mo(A)	CG-181*	5945-00-101-9396	0.40/0.60/2.00/5.00	0.30
ISO 2	CG-181*	5945-01-GL3-6064	1.00/1.00	0.50
	CG-481	5895-01-GL7-6171		
ISO 6	CG-181*	5945-00-007-7943	3.00/3.00	0.50
	CG-481	5945-01-GL3-5356		
OC 4	CG-181*	5945-00-007-7944	3.00/1.00	0.75
	CG-481	5945-01-GL3-5355		
Fixed	CG-181*	5945-00-007-7945	Continuous	1.00
	CG-481	5945-01-GL3-5354		
Programmable	CG-493	5945-00-460-3349	Programmable	Programmable

* Fixed rhythms are no longer being purchased and will be replaced by programmable flashers as supplies are exhausted.

Data Sheet 6-E(6). (cont'd).



Function. The 120-volt lamps are used when a light with a nominal range greater than 9 nm is required and commercial power is available. These lamps can be used in fixed and rotating lanterns to generate pencil beams and omnidirectional fan beams.

Features.

- Omnidirectional light output in the horizontal plane.
- Incandescent filament.
- Tungsten-Halogen for long life expectancy and high lumen maintenance.
- Quartz bulbs.
- Large filaments for easy focusing and large vertical divergences.

Related Equipment.

- The 1000W lamp is used in the 24-inch optics, including the DCB24, DCB224, and RL24. It may also be used in classical lenses.
- The 250W lamp is used in the 250mm and 300mm signal lanterns, and may also be used in the RL14 range lantern and smaller classical lenses.
- The 150W lamp is used in the FA-251-AC rotating beacon and the RL14 range lantern.
- The Carlisle & Finch Company manufactures a two-place, horizontal-swing lampchanger (CG-2P) for use with the 1000W lamp.
- Tideland Signal Corporation manufactures a four-place lampchanger (CG-4P) for use with both the 250W and 150W lamps.
- The FLAC-300 (Data Sheet 6-E(12)), the AC flash controller and the Audio-Visual Controller, described in Chapter 8, are used to flash 120-volt lamps.

Data Sheet 6-E(7). 120-Volt Lamps.

Table 6-6
120-volt Lamp Specifications

Lamp power rating (watts)	1,000	150	250
Current (amps)	8.33	1.25	2.08
Bulb type	T-20	T-4	T-4
Base type	mogul bi-post	DC bayonet	DC bayonet
Minimum on time (sec)	0.62	0.30	0.30
Life expectancy (hr)	3,000	2,000	2,000
Lumen output (lm)	17,200	2,600	4,700
NSN/ANSI Code	6240-00-905-7512	ETC	ESS

Additional Data. The 1000W lamps are manufactured by the General Electric Company, and are available for purchase from Engineering Logistics Center Baltimore. The dimensions of the lamp are illustrated in figure 6-8(a). The 150W and 250W lamps are manufactured by several companies, including General Electric and Wiko. These lamps are purchased from local lamp suppliers. For greater reliability, purchase 150W and 250W lamps with central filament supports. Be especially careful to use the correct ANSI Code, listed in Table 6-6, when purchasing the 150W lamp, as there is a similar lamp in the Federal Supply System that has a filament that resembles an upside-down V. This lamp is not suitable for use in AtoN beacons and lanterns. The 150W and 250W lamps, and the dual-contact bayonet base, are illustrated in figures 6-8(b) & (c).

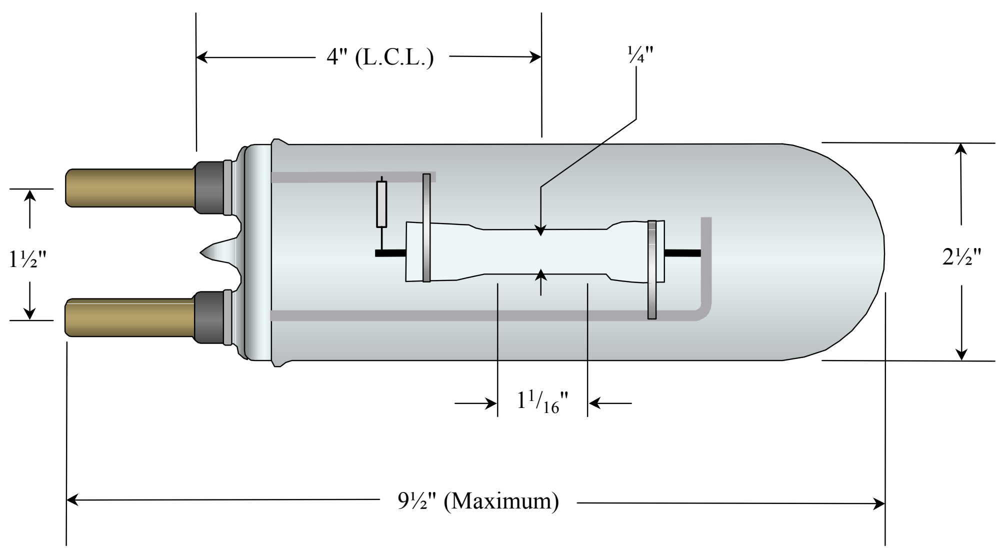


Figure 6-8(a). 120-volt, 1000 watt Lamp with Mogul Bi-post Base.

Data Sheet 6-E(7). (cont'd).

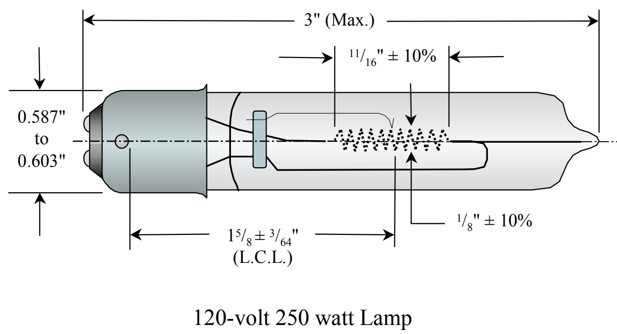


Figure 6-8 (b). 120-volt, 250 watt Lamp with Dual-Contact (DC) Bayonet Base.

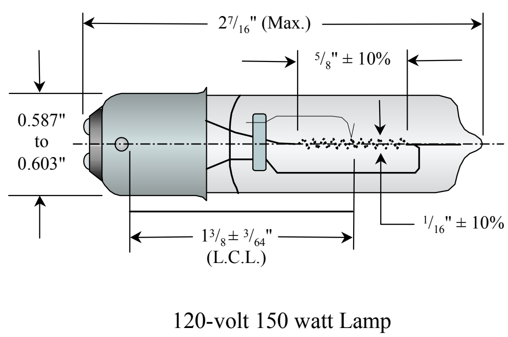


Figure 6-8 (c). 120-volt 150 watt Lamp with Dual-Contact (DC) Bayonet Base.

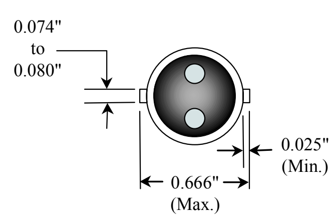
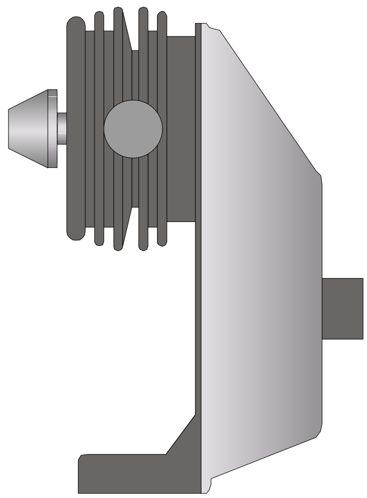
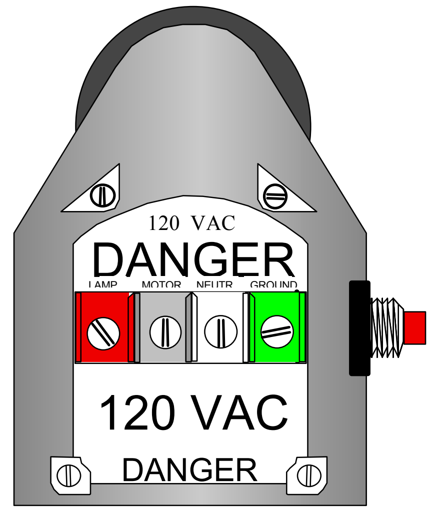


Figure 6-8 (d). Dual-Contact (DC) Bayonet Base for 120-volt Lamps.

Data Sheet 6-E(7). (cont'd).

6.E. 120VAC Four-Place Lampchanger (CG-4P)





Function. The CG-4P lampchanger supports four 120-volt 250 or 150 watt lamps with the filament of the operating lamp at the focal point of the lantern. A lamp-out sensing circuit automatically rotates the turret (CCW) to the next serviceable lamp. In the event that all four lamps fail, the CG-4P lampchanger secures power to the lamp circuit.

Features.

- Fixed contact assembly; no moving electrical contacts or brushes other than lamps.
- Automatic contact cleaning before each lamp is activated.
- Lamps easily installed and removed; push in to install, tilt and pull out to remove.
- Symbolic "X" formed when all four lamps are burned out; serves as a visual alarm.
- Test button simulates lamp failure and activates turret motor.
- Fail-safe lamp-out sensing not affected by power outages or daylight controlling.
- Conical profile reduces lampchanger shadowing.
- Heat sinking built into turret maintains cool lamp base temperature.
- Turret thermally isolated from electronic enclosure by Teflon bushing.

Electrical Characteristics.

- Input voltage range.................100-130VAC.
- Frequency range ....57-63 Hz.
- Operating impedance ....5000 ohm (maximum).
- End of search..........................10 megohm (minimum) impedance.
- Control circuit power ....5 watt (maximum) continuous.
- Safety ....Frame, turret & cover are electrically grounded.

Data Sheet 6-E(8). 120VAC Lampchanger (CG-4P).

6.E.

<u>Mechanical Characteristics</u>. The basic dimensions of the CG-4P lampchanger are illustrated in figure 6-9. Note that the mounting holes for the lampchanger are threaded for 10-32 screws. This allows the lampchanger to be mounted to the lampchanger bracket without requiring nuts.

- Weight....................................24 oz.
- Mounting Pattern ....3.00" x 0.625" ± 0.005" (threaded holes).
- Mounting Screws ....10-32 x .50 binding head (4 required).
- Lamp Focal Position
  250 watt lamps.......................6.500" ± 0.062" above and central to mounting pattern.
  150 watt lamps.......................6.250" ± 0.062" above and central to mounting pattern.

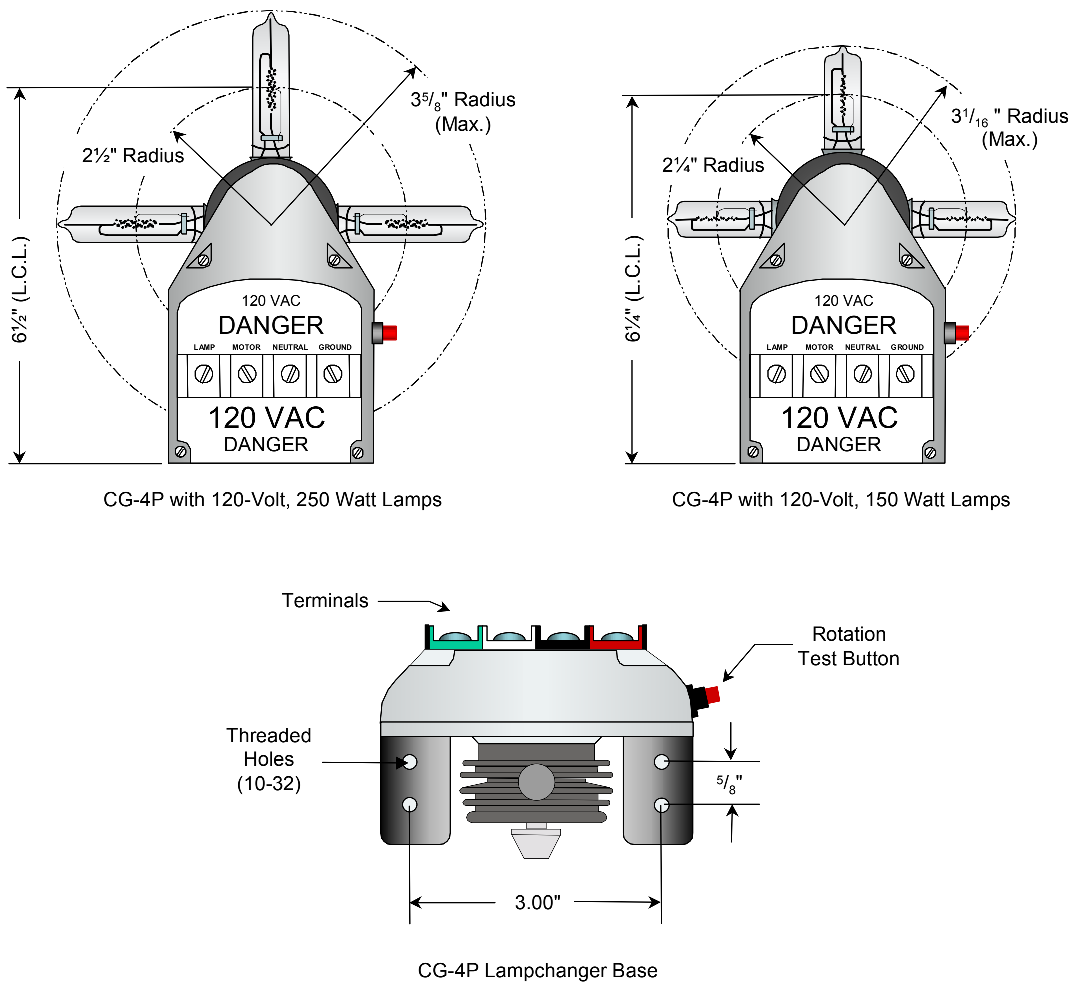


Figure 6-9. Dimensions of the CG-4P Lampchanger

Data Sheet 6-E(8). (cont'd).

Related Equipment. The CG-4P lampchanger fits the following Coast Guard optics:

- 300mm Marine Signal Lantern—Use adapter mounting bracket, Tideland Signal Corporation P.N. 245.1265. Only the 120-volt, 250 watt lamp will be used with the 300mm lantern and the CG-4P lampchanger.
- 250mm Marine Signal Lantern (vented)—Use lampchanger bracket kit, Automatic Power, Inc., P.N. 2101-146. Only the 120-volt, 250 watt lamp will be used with the 250mm lantern and the CG-4P.
- FA-251-AC Rotating Beacon—Use the lampchanger bracket provided with the beacon. Only the 120-volt, 150 watt lamp may be used in the FA-251-AC.
- RL14 Range Lantern—Use the mounting blocks and lampchanger bracket provided with the beacon. Both 120-volt 250 watt and 150 watt lamps may be used in the RL14 Range Lantern. ***Insure that the mounting blocks and lampchanger bracket are correctly positioned for the selected lamp***.

For CG-4P lampchanger may be used by itself, or wired to a FLAC-300 flasher. Wire harness is provided with the FLAC-300. When used by itself, a K-4121 120-volt photoresistor is used to provide daylight control.

Wiring. The CG-4P lampchanger may be wired for fixed-on or flashing operation, with or without daylight control. In the fixed-on mode without daylight control, the lamp and motor (turret) inputs are connected by a jumper. For all other modes of operation the jumper is removed. Standard wiring shall be 12/3 SO cable through a watertight stuffing tube, or individually insulated wires installed in conduit. Leads shall be terminated with insulated spring spade lugs. Figures 6-10 and 6-11 are the wiring diagrams for a CG-4P operating in fixed-on mode, without and with daylight control, respectively. Figure 6-12 is the wiring diagram for the CG-4P operating in a flashed mode (with daylight control).

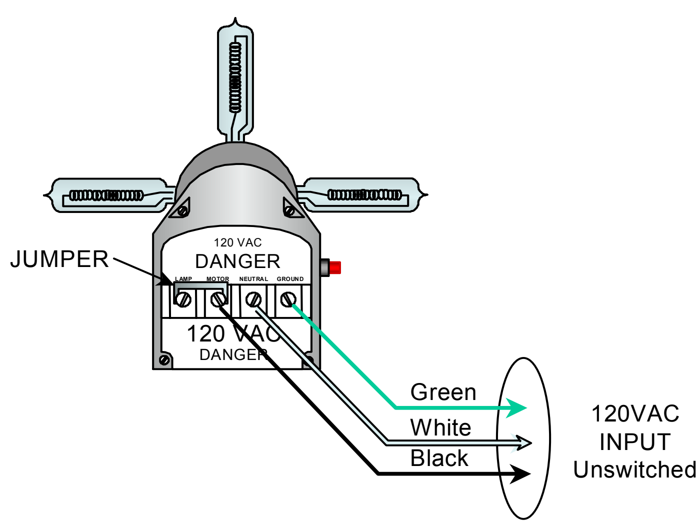


Figure 6-10. CG-4P Lampchanger—Fixed-on with no daylight control.

Data Sheet 6-E(8). (cont'd).

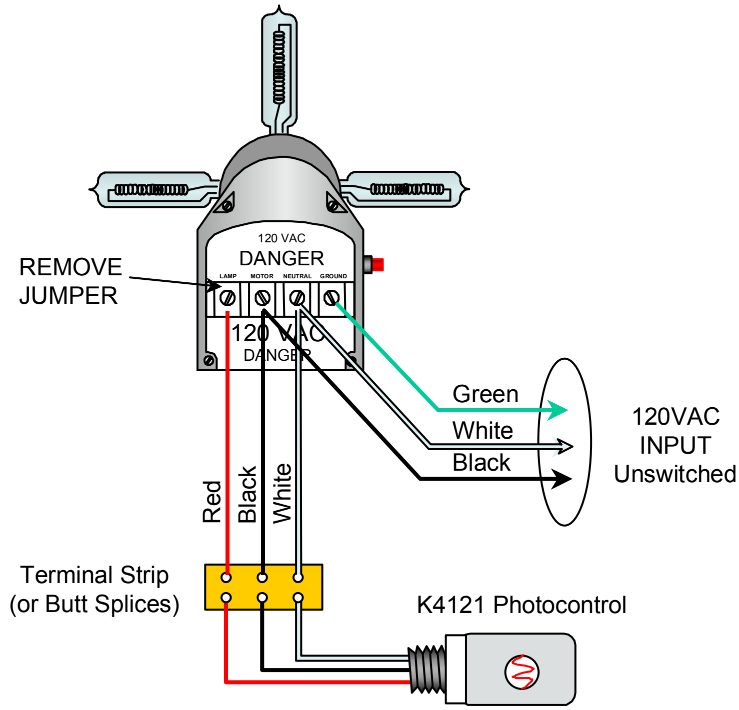


Figure 6-11. CG-4P Lampchanger—Fixed-on with daylight control

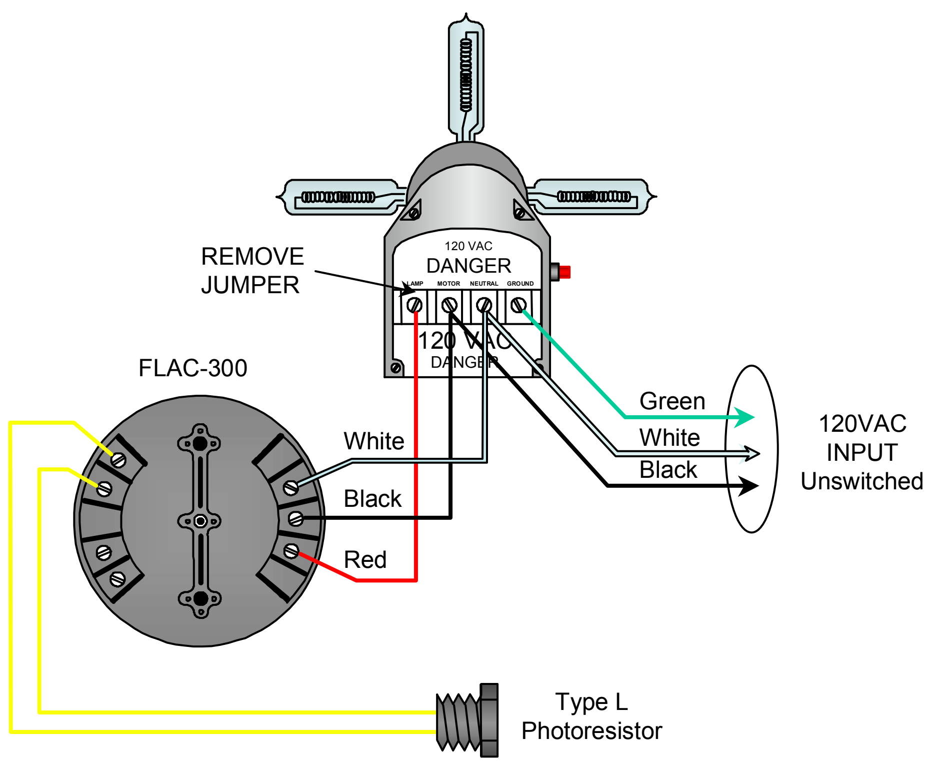


Figure 6-12. CG-4P Lampchanger—Flashing with daylight control.

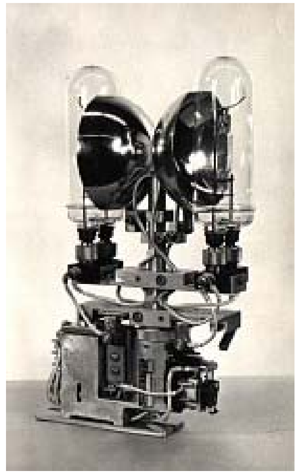
Data Sheet 6-E(8). (cont'd).

6.E.

Additional Data. Technical specifications for the CG-4P Lampchanger are provided in G-ECV Specification 266. The lampchanger may be purchased as a Commercial-Off-the-Shelf (COTS) item from Tideland Signal Corporation, P.O. Box 52430, Houston, Texas, 77052, (713) 681-6101, P.N. 630.1087-00. Reconditioned lampchangers (P.N. RC630.1087-00) are also available, with turn-in of a defective unit. Tideland Signal Corporation provides a standard commercial warranty, with a one-year period, on the CG-4P lampchanger.

Data Sheet 6-E(8). (cont'd).

120VAC Two-Place Lampchanger (CG-2P)



Function. The CG-2P lampchanger supports two 120-volt, 1000 watt lamps with the filament of the operating lamp at the focal point of the 24-inch optics. A lamp out sensing circuit automatically rotates the lampchanger to the secondary lamp in the event of failure of the primary lamp.

Features.

- Holds two 120-volt, 1000 watt lamps with mogul bi-post bases.
- Spring-wound rotation mechanism.
- Trip lever to manually test rotation.
- Relay closes in secondary lamp position; provides monitor information.
- Word "TRIPPED" displayed when in secondary position.
- Pre-focused at point of manufacture.
- Horizontal position of lamp sockets adjustable.
- Auxiliary reflectors to improve light-capture.
- New lampchangers include arc-suppression, to eliminate arcing when rotating to secondary position.

Electrical and Mechanical Characteristics.

- Input voltage range.................120 VAC ±10%.
- Frequency range.....................60 Hz ±10%.
- Voltage drop...........................≤ 0.5 volts.
- Weight...................................24 oz.
- Ambient temperature ....-30˚ to +140˚F

Related Equipment. The lampchanger is used with all standard Coast Guard 24-inch optics; the DCB24 and DCB224 rotating beacons, and the RL24 range lantern.

Data Sheet 6-E(9). 120VAC Two-Place Lampchanger (CG-2P).

Additional Data. All 24-inch optics come with the CG-2P lampchanger installed, and adjusted for optimal focus. Instructions on how to check and adjust the focus, and wiring guidelines, are outlined in the data sheets for the 24-inch optics. Figure 6-13 illustrates the physical dimensions of the CG-2P lampchanger. The CG-2P lampchanger may be purchased as a Commercial-Off-The-Shelf (COTS) item from The Carlisle & Finch Company, 4562 West Mitchell Ave., Cincinnati, Ohio, 45232-1798, (tel) (513) 681-6080, P.N. LC8949.

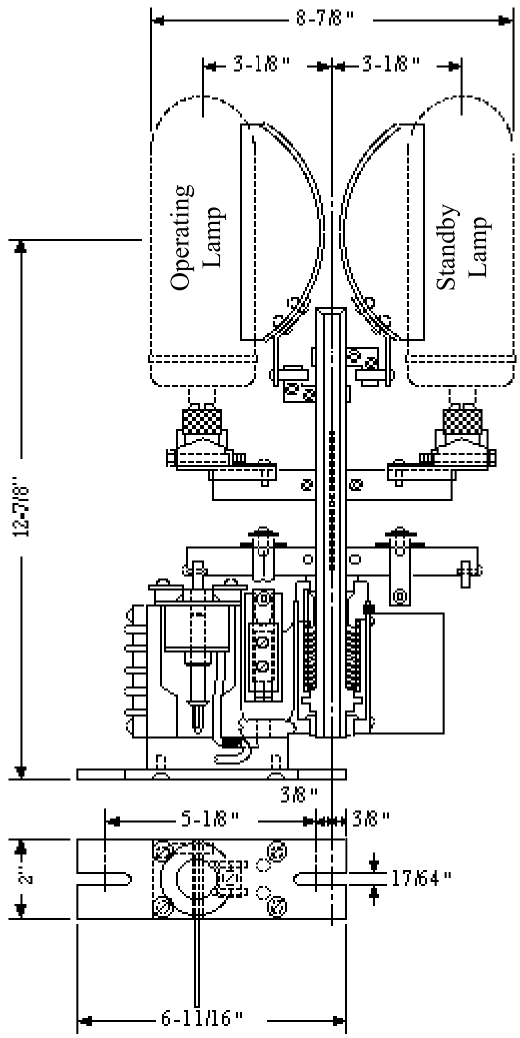
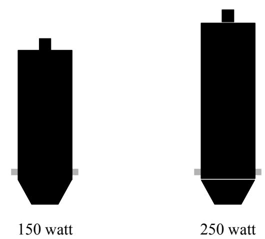


Figure 6-13. Dimensions of CG-2P Lampchanger

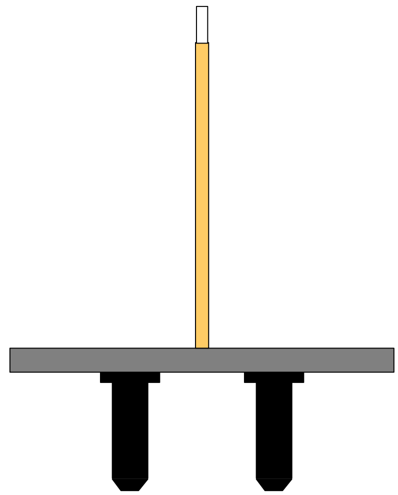
Data Sheet 6-E(9). (cont'd).

6.E.

120-Volt Focus Fixture



For use with CG-4P



For use with CG-2P

Function. Focus fixtures are used to assist in the focusing of optics by placing an item with a defined height in the appropriate 120-volt lampchanger within an adjustable optic. There are three different 120-volt focus fixtures: (1) for the 250 or 300mm marine signal lanterns outfitted with 250 watt lamps, (2) for the FA-251-AC rotating beacon with 150 watt lamps, and (3) for the 24-inch optics. The focus fixtures for use with the 250 and 150 watt lamps are commercial items. The focus fixture for use with 24-inch optics (DCB24 and DCB224 rotating beacons and RL24 range lantern) is called a "dummy lamp gauge." A dummy lamp gauge is part of the initial provisioning provided with a 24-inch optic.

Related Equipment. Focus fixtures are used with the appropriate lampchanger for the optic and application.

Additional Data. Purchase of a 120-volt focus fixtures for use with the 250 or 150 watt lamps may be made as a Commercial-Off-The-Shelf (COTS) procurement from Tideland Signal Corporation, P.O. Box 52430, Houston, Texas, 77052, (713) 681-6101. The part number for the focus fixture for the 250 watt lamp is P/N 342.1055-01. The part number for the focus fixture for the 150 watt lamps is P/N 342.1055-04. These focus fixtures look the same; the only difference being their overall height. Be sure to use the correct focus fixture. The dummy lamp gauge (focus fixture) for 24-inch optics may be fabricated locally or purchased from The Carlisle & Finch Company, 4562 West Mitchell Ave., Cincinnati, Ohio, 45232-1798, (tel) (513) 681-6080. Instructions on fabricating the dummy lamp gauge are provided in the AC Servicing Guide.

Data Sheet 6-E(10). 120-Volt Focus Fixtures.

6.E.

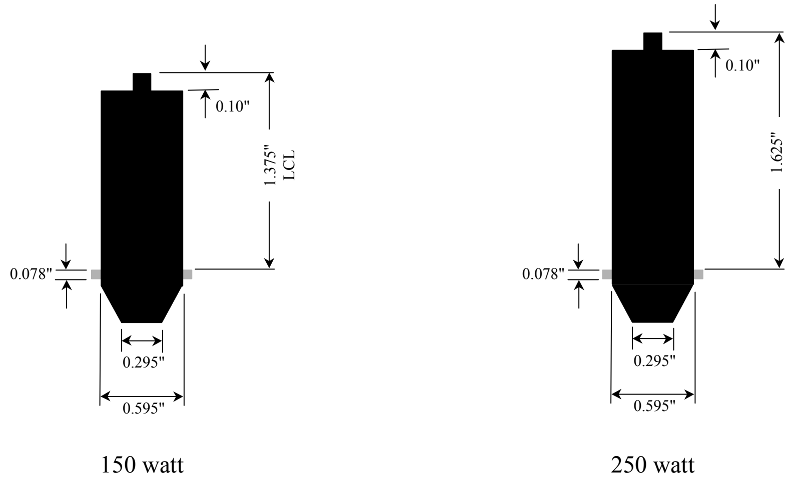


Figure 6-14. Dimensions of the 120-Volt Focus Fixtures used with the CG-4P.

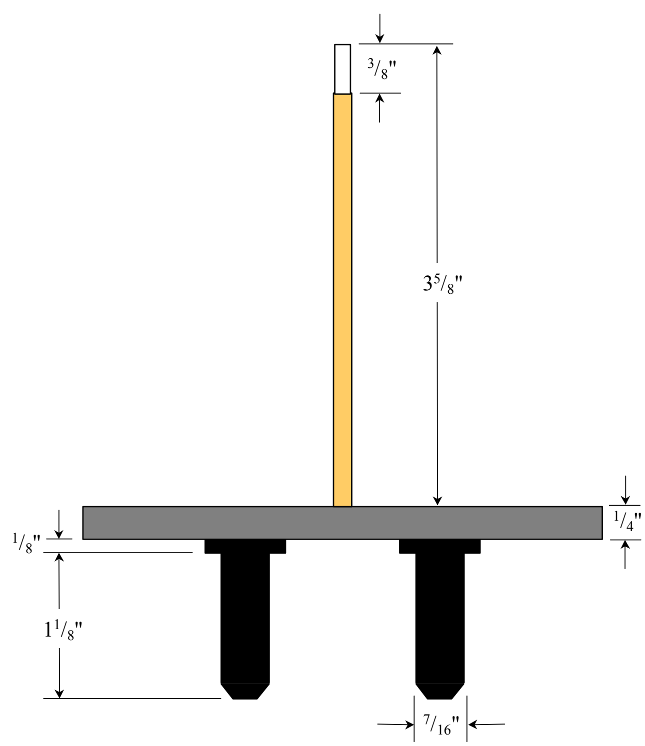
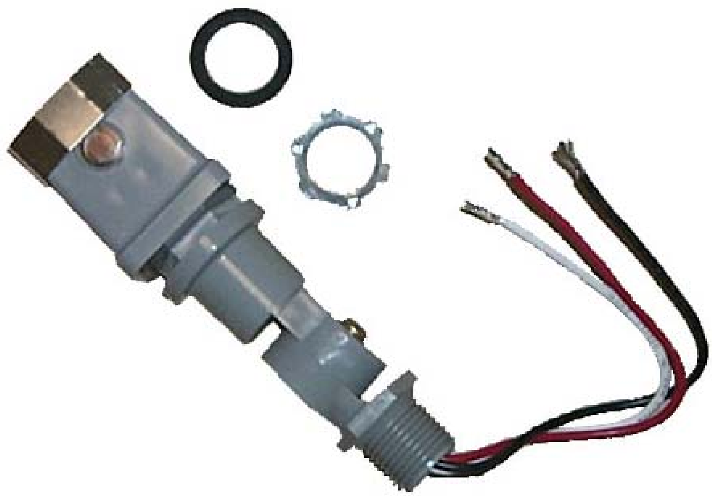


Figure 6-15. Dimensions of the "Dummy Lamp Gauge" used with the CG-2P.

Data Sheet 6-E(10). Focus fixture.

12VAC Photocell (Type K DLC)



Function. The 120VAC photocell (Type K DLC) is a switch controlled by a photoresistor. The photoresistor changes resistance as the ambient light level changes, causing a bi-metallic thermal switch to open or close. At sunset, the switch will close, completing the electrical circuit, and allowing a light to be energized. At sunrise, the switch opens, causing the light to turn off.

Features.

- Direct control of loads, up to and including 120-volt, 1000 watt lamps.
- Available with and without a swivel base.
- Hermetically sealed.
- Low cost, non-repairable items, with 5-year warranty.

Related Equipment. The Type K DLC may be used with the CG-4P lampchanger, to daylight-control fixed-on lamps. The 120VAC photocell is also used with the Range Switch Box-AC (RSB-AC), described in Chapter 9. The Type K DLC has a ½" NPT fitting. A ¾" to ½" reducer pipe bushing is needed to install the Type K DLC in standard AtoN lanterns.

Additional Data. Type K DLCs are purchased commercially from electrical distributors. Acceptable items include the Intermatic K-4121 and K-4221 (shown above) photocells, and the Precision Photocontrol Lumatrol T-15 and ST-15 photocells. The K-4221 and ST-15 photocells have swivel bases, and are preferred when used with the RSB-AC. The wiring schematic for a Type K DLC and CG-4P lampchanger is illustrated in figure 6-11 (Data Sheet 6-E(8)). As the switching action in a Type K DLC is a thermal process, allow up to 5 minutes for switching when testing the operation of a Type K DLC by covering and uncovering the photoresistor.

Data Sheet 6-E(11). 120-Volt Photocell (Type K DLC).

120VAC Flasher (FLAC-300)

Function. The FLAC-300, when used in conjunction with the CG-4P lampchanger, will provide timing-codes (flashes) for a wide range of flash rhythms. It may be used with the 120-volt, 150 watt and 250 watt lamps. A Type-L daylight control is used to command the light off during daylight hours.

Features.

- Solid-state electronic components.
- Field-adjustable flash rhythms (256 available).
- Watertight, non-metallic container.
- Gold-plated electrical contacts.
- Replaceable plug-in circuit cards.
- Integrated lightning protection.
- Can be synchronized by a landline.
- Provisions for daylight control.

Electrical Characteristics.

- Input voltage ....120 volts AC, 50-60 Hz
- Output voltage........................120 volts AC
- Maximum load.......................250 watts
- Ambient temperature range....-30C to +55C
- Timing tolerance ....±6%

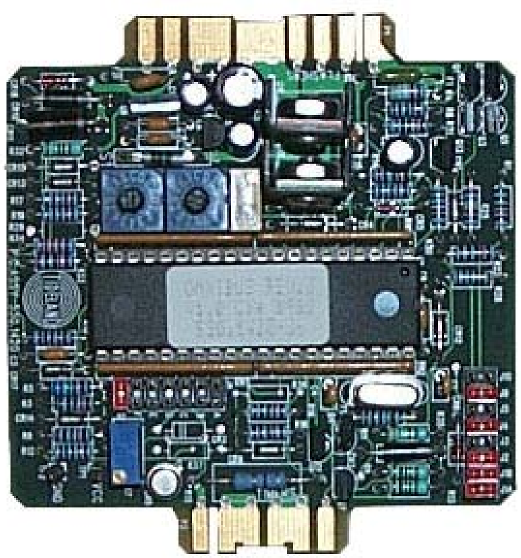
Data Sheet 6-E(12). 120VAC Flasher (FLAC-300).

Mechanical Characteristics.

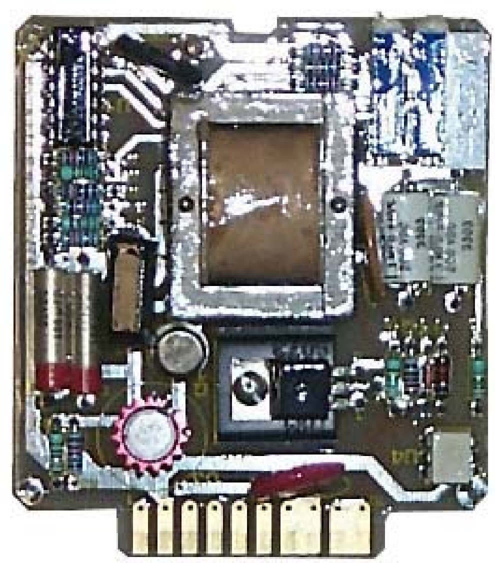
- Height....................................4 ⅝" (117mm)
- Diameter................................3 $^{15}/_{16}$" (100mm)
- Weight...................................16 oz (0.45kg)

Related Equipment. The FLAC-300 Flasher is used with the CG-4P lampchanger outfitted with 120-volt, 150 or 250 watt lamps. A Type L daylight control may be added to provide day/night switching. The FLAC-300/CG-4P combination may be used in the 250mm and 300mm marine signal lanterns (with 250 watt lamps only), and the RL-14 range lantern. The wiring schematic for the FLAC-300/CG-4P combination is illustrated in figure 6-12 (Data Sheet 6-E(8)).

Additional Data. The FLAC-300 Flasher has two replaceable cards, the FLAC-300 card and the omnibus flasher time card. The FLAC-300 card provides for daylight control of the aid, and allows aids to by synchronized. The omnibus flasher time card controls the flash rhythm. Both cards are inserted into edge connectors on the FLAC-300 motherboard; located on the backside of the flasher cap. Figure 6-16 illustrates the two cards found in the FLAC-300. The FLAC-300 motherboard is shown in figure 6-17. Figure 6-18 shows how the cards are plugged into the motherboard. The FLAC-300 may be purchased as a Commercial-Off-the-Shelf (COTS) item from Tideland Signal Corporation, P.O. Box 52430, Houston, Texas, 77052, (713) 681-6101, P.N. 520.1163-01. Reconditioned flashers are available (add "RC" before the P.N.) with turn-in of a defective unit. Tideland Signal Corporation provides a standard commercial warranty, with a one-year period, on the FLAC-300.



Omnibus Flasher Time Card



FLAC-300 Card

Figure 6-16. FLAC-300 Flasher Cards.

Data Sheet 6-E(12). (cont'd).

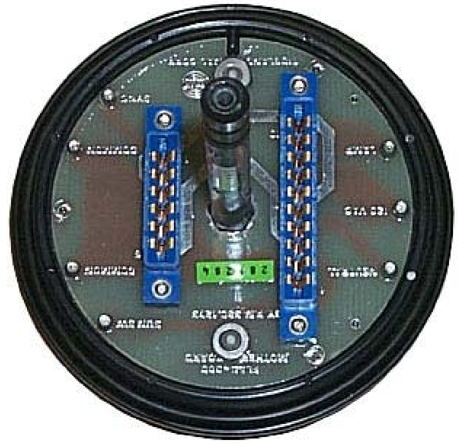


Figure 6-17. FLAC-300 Motherboard

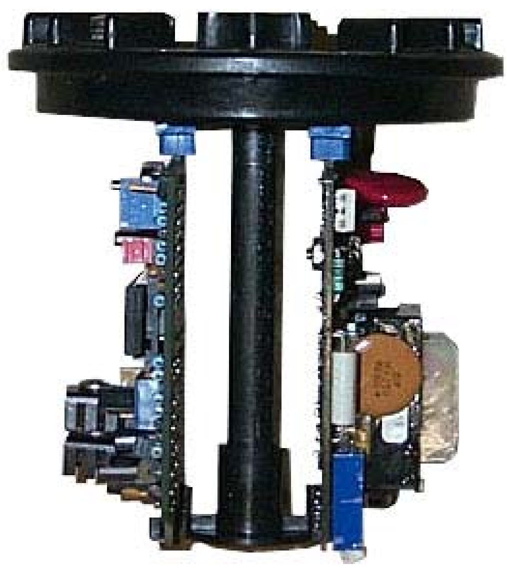


Figure 6-18. FLAC-300 Card Assembly

Rhythm Selection. The omnibus flasher time card has two rotary switches that permit selection from among 256 rhythms. (Earlier versions of the FLAC-300 had pre-set time cards that could not be adjusted.) A *Code Selection Guide* booklet is available from Tideland Signal Corporation, P.O. Box 52430, Houston, Texas, 77052, (713) 681-6101, P.N. 011.1092-00. Ordering units may specify the rhythm, if factory preset of the timer card is desired. If no rhythm is specified, the FLAC-300 will be factory set for a Quick Flash (Q) rhythm (0.3 second flash, 0.7 second eclipse).

Data Sheet 6-E(12). (cont'd).

Tideland Signal Corp. Automatic Power, Inc

Function. The 155mm lantern is approved for use on buoys and single-pile wooden structures. A maximum omnidirectional range of 8nm can be obtained with standard 12-volt lamps.

Features.

- High-impact plastic base with four 1/16-in. drain holes
- Replaceable clear, green, red, or yellow acrylic lenses
- No focusing adjustment (insure lampchanger bracket is not deformed).

Related Equipment. The 155mm lantern must be equipped with the following standard 12VDC equipment—12-volt lamps, CG-6P lampchanger, CG-181/493 flasher, daylight control, and WK-681 wiring kit. Only the 0.25 amp through the 2.03 amp tungsten-filament marine signal lamps may be used with the 155mm lantern.

Wiring. The power lead for the 155mm lantern shall be 12/2 SO cable, installed through a watertight stuffing tube, or individually insulated wires installed in conduit. Wires shall be terminated with spade lugs. The wiring convention uses black for positive (+) and white for negative (-). Procedures for wiring the 155mm lantern are as follows:

(1) Wire a CG-6P lampchanger and CG-181/493 flasher together, following the procedures in data sheet 6-E(6). The lampchanger and flasher are secured to the bracket that is supplied with the lantern (with the dip down) using four 10-32x1" screws.

(2) Secure the lampchanger/flasher assembly to the lantern base using the screws provided. The lock washer must be on top of the bracket, or the focal height of the lamp will be affected.

(3) Install the power leads. Terminate the leads with spade lugs and attach to the CG-181/493 flasher input terminals.

Data Sheet 6-E(13). 155mm Buoy Lantern

Installation.

a. Structures: Figure 6-19 illustrates the procedures for mounting a 155mm lantern to a structure. Step-by-step instructions are outlined below:

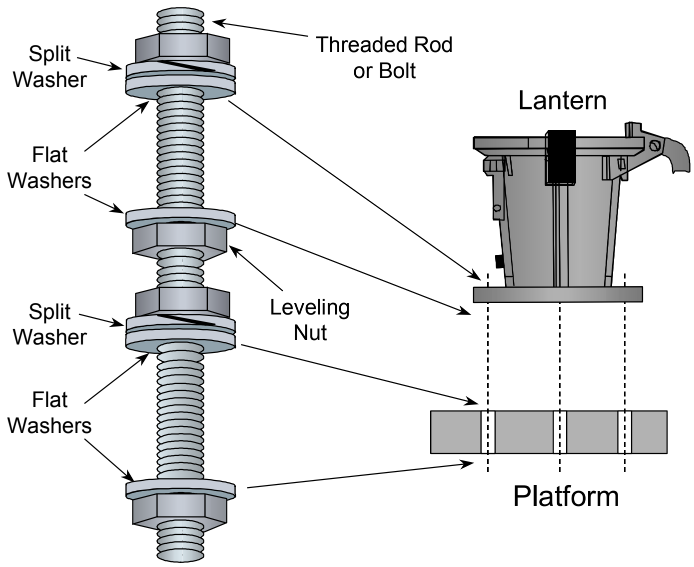


Figure 6-19. Mounting a 155mm Buoy Lantern to a Structure.

(1) Install three 1/2" stainless steel threaded rods or bolts on the platform. If using bolts, the bolt-head should be against the underside of the platform. Tighten the nut on the top of the mounting platform until the split washer is just compressed. Add the leveling nut and flat washer to each threaded rods or bolts.

(2) Position the lantern over the three mounting rods/bolts. Place a flat washer, split washer, and a nut on each rod but do not tighten.

(3) Leveling of the lantern should be adjusted using the “T” method (figure 6-20).

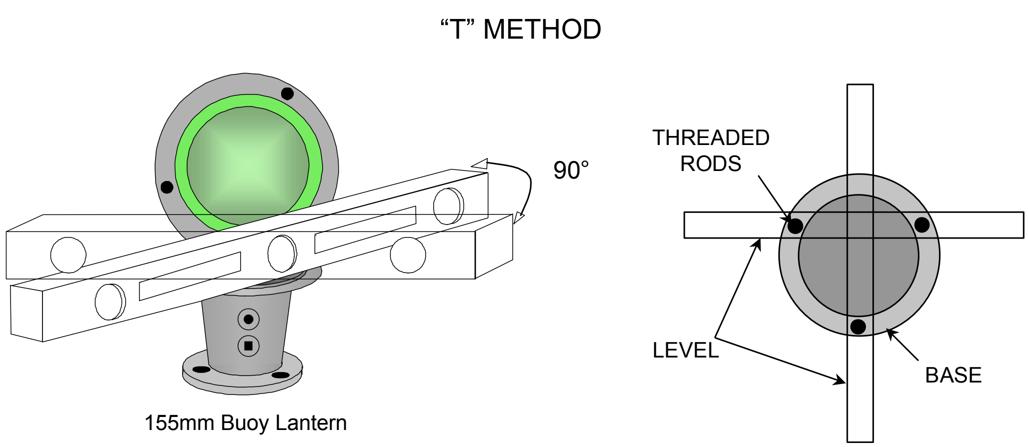


Figure 6-20. Leveling the 155mm Buoy Lantern

Data Sheet 6-E(13). (cont’d).

(4) With the lens open, place a level on the flange of the lantern base so that the level is directly over two of the mounting rods/bolts.

(5) Adjust one or both of the leveling nuts under the level up or down until the lantern is level in this orientation.

(6) Rotate the level ninety (90) degrees from the initial orientation and adjust the third leveling nut, if necessary.

(7) Repeat steps (4) through (6) until the lantern in level in both directions.

(8) Tighten the top nuts on each mounting rod/bolt until the split washer is compressed and recheck level. DO NOT OVER-TIGHTEN.

b. Buoys:

(1) Align the lantern base with the holes in the buoy plate.
(2) Place a ½" threaded stainless steel bolt through each of the aligned holes.
(3) Secure the lantern with a stainless steel flat washer, lock-washer and nut on each bolt.
(4) Note: Lanterns installed on buoys are not leveled.

Focusing. The 155mm lantern is a prefocused optic; the focus is not adjustable. The focus should be checked upon initial installation and when the flasher, lampchanger, or lampchanger bracket are changed, to ensure that components are installed correctly and that the bracket and base are not bent or distorted. The 155mm lens has four sighting marks: two adjacent clear circles with opposing circles engraved with an "X."

(1) Install a 12-volt focus fixture in the first position of an installed lampchanger.
(2) Secure the lens to the base.
(3) Sight through one of the two clear sighting marks on the lens, to the opposite sighting mark scribed with an "X." The focus fixture should appear centered in the sight marks (see figure 6-21).
(4) Verify proper focus through the second pair of sighting marks.
(5) If the lantern is not properly focused, check for proper installation of lampchanger bracket (dip down), lock washers (on top of bracket), or for deformation of the bracket or broken standoffs in the base. Replace bent or broken components.

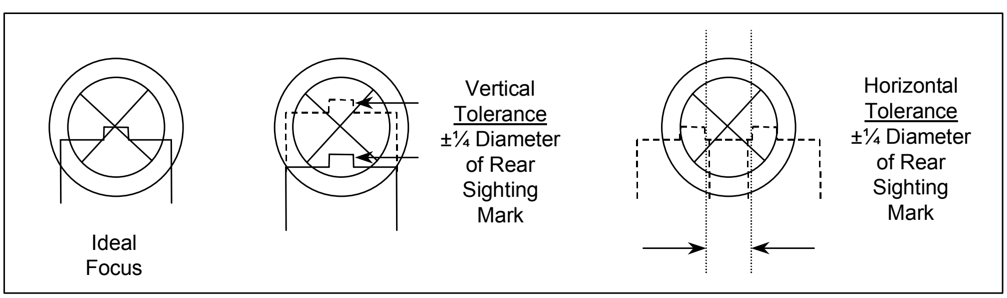


Figure 6-21. Focus Picture for 155mm Buoy Lantern.

Data Sheet 6-E(13). (cont'd).

6.E.

Performance Characteristics. The performance characteristics of the 155mm buoy lantern are provided in Table 6-7.

Table 6-7
155mm Buoy Lantern Performance with 12-volt Lamps

NOMINAL RANGES (NMI) – 155 MM LANTERN (ACRYLIC LENS)

LENS	LAMP 12V	FL 2.5(0.3) FL (2+1) 6 Q	FL 4(0.4) FL (2) 5 Mo (A) (0.4, 2.0)	FL 6(0.6)	FL (2) 6 FL 2.5(1) ISO 2	ISO 6 OCC 4	FIX
CLEAR	0.25A	4	4	4	4	4	4
	0.55A	5	5	5	5	6	6
	0.77A	5	6	6	6	6	6
	1.15A	6	6	6	7	7	7
	2.03A	6	7	7	8	8	8
YELLOW	0.25A	3	4	4	4	4	4
	0.55A	4	5	5	5	5	5
	0.77A	5	5	5	6	6	6
	1.15A	5	6	6	6	6	6
	2.03A	6	6	7	7	7	8
RED	0.25A	2	2	3	3	3	3
	0.55A	3	3	4	4	4	4
	0.77A	4	4	4	4	4	4
	1.15A	4	4	4	5	5	5
	2.03A	5	5	5	6	6	6
GREEN	0.25A	3	3	3	3	3	3
	0.55A	3	4	4	4	4	4
	0.77A	4	4	4	5	5	5
	1.15A	4	5	5	5	5	5
	2.03A	5	5	6	6	6	6
LAMP CURRENT RATING (AMP)			0.25	0.55	0.77	1.15	2.03
VERTICAL DIVERGENCE (DEG)							
50% BEAM WIDTH			±1.7	±2.1	±2.6	±2.6	±2.5
15% BEAM WIDTH			±2.2	±3.7	±3.7	±3.9	±3.8
NOTE: Consult the Visual Signal Design Manual for intensities							

Dimensions. Ocean Engineering Drawing No. 120085, dated 19 February 1970, established the dimensional guidelines for manufacturers of 155mm buoy lanterns. The overall dimensions of the Automatic Power, Inc. (API) version of the lantern are illustrated in figure 6-22. The weight, without flasher and lampchanger, is approximately 7 lbs. Fully outfitted, the lantern weighs 9½ to 10 lbs. (4.5 kg).

Data Sheet 6-E(13). (cont'd).

6.E.

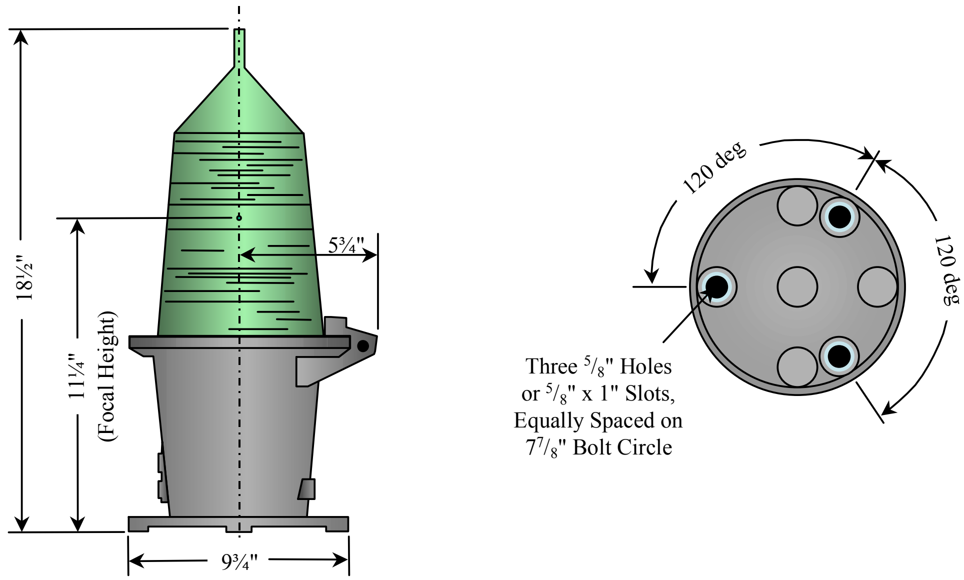


Figure 6-22. 155mm Buoy Lantern Dimensions (API version).

Additional Data. Technical specifications for the 155mm buoy lantern are listed in G-ECV Specification 205. The 155mm lantern and lenses are stocked at the Engineering Logistics Center. The following are applicable stock numbers for the lanterns and lenses:

- 155-mm lantern
  - Clear lens 6210-01-029-4172
  - Green lens 6210-01-029-4173
  - Red lens......................6210-01-029-4174
  - Yellow lens 6210-01-153-7620
- Tideland Lenses
  - Clear...........................6210-01-035-0417
  - Green..........................6210-01-035-0418
  - Red.............................6210-01-095-5826
  - Yellow........................6210-01-156-7860
- API Lenses
  - Clear...........................6210-01-043-0753
  - Green..........................6210-01-035-0416
  - Red.............................6210-01-039-8420
  - Yellow........................6210-01-156-7861

The Tideland lens can be used as a ***temporary*** replacement on the API base by using the hinge pin and three captive screws and washers that come with the API lantern. This combination should be replaced with a standard base/lens combination as soon as practical.

Data Sheet 6-E(13). (cont'd).

6.E.

200mm Buoy Lantern

Function: The 200mm buoy lantern provides an omnidirectional light on buoys and piles where light-to-moderate icing is expected and on exposed bars and jetties subject to breaking water. A maximum nominal range of 8nm is obtained with 12-volt lamps.

Features.

- Aluminum base.
- Glass lens.
- Aluminum lid.
- No focusing adjustment.

Related Equipment. The 200mm buoy lantern must be equipped with the following standard 12VDC equipment—12-volt lamps, CG-6P lampchanger, CG-181/493 flasher, daylight control, and WK-681 wiring kit. (Note: A Type B daylight control is used with the 200mm lantern with red or green glass lenses. These daylight controls are stocked at COMDT (G-SEC-2A). Requests for Type B daylight controls should be made by e-mail or letter to Commandant (G-SEC-2A)).

Wiring. Follow the instructions for wiring the 155mm buoy lantern, Data Sheet 6-E(13).

Installation. Follow the instructions for installing the 155mm buoy lantern, Data Sheet 6-E(13). Note: use the three slots around the base that are separated by 120 degrees for mounting the lantern (see figure 6-24). Use only three of the four uniformly spaced lots found on older 200mm buoy lanterns.

Data Sheet 6-E(14). 200mm Buoy Lantern

Focusing. The 200mm lantern is a prefocused optic; the focus is not adjustable. The focus should be checked upon initial installation and when the flasher, lampchanger, or lampchanger bracket are changed, to ensure that components are installed correctly and that the bracket and base are not bent or distorted. The 200mm lens has four raised ovals for sighting marks.

(1) Install a 12-volt focus fixture in the first position of an installed lampchanger.
(2) Secure the lens to the base.
(3) Sight through one of the sighting marks on the lens to the opposite sighting mark. To improve the visibility of the rear sighting mark, a gummed paper reinforcement may be temporarily placed around the rear oval. The focus fixture should appear centered in the sight marks (see figure 6-23).
(4) Verify proper focus through the second pair of sighting marks.
(5) If the lantern is not properly focused, check for proper installation of lampchanger bracket (dip down), or for deformation of the bracket or broken standoffs in the base. Replace bent or broken components.

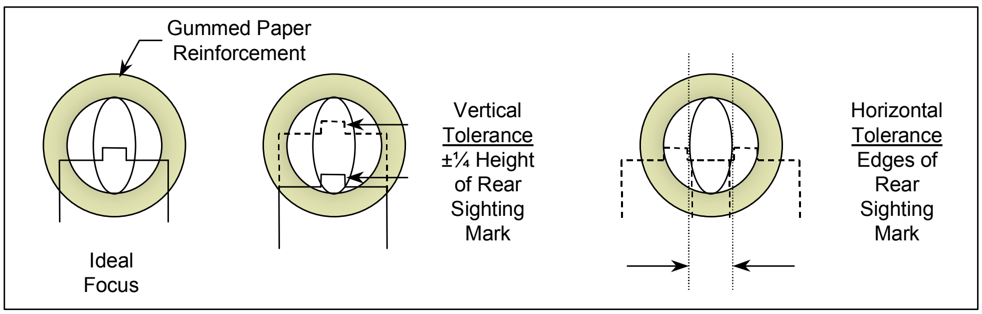


Figure 6-23. Focus Picture for 200mm Buoy Lantern.

Performance Characteristics.

Table 6-8
200mm Buoy Lantern Performance with 12-volt Lamps
NOMINAL RANGES (NMI) – 200 MM LANTERN (GLASS LENS)

LENS	LAMP 12V	FL 2.5(0.3) FL (2+1) 6 Q	FL 4(0.4) FL (2) 5 Mo (A) (0.4, 2.0)	FL 6(0.6)	FL (2) 6 FL 2.5(1) ISO 2	ISO 6 OCC 4	FIX
CLEAR	0.25A	3	3	3	4	4	4
	0.55A	4	4	5	5	5	5
	0.77A	5	5	5	5	6	6
	1.15A	5	5	6	6	6	6
	2.03A	6	6	7	7	7	8
	3.05A		7	7	8	8	8
YELLOW	0.25A	2	2	3	3	3	3
	0.55A	3	3	4	4	4	4
	0.77A	4	4	4	4	4	5
	1.15A	4	4	5	5	5	5
	2.03A	5	5	6	6	6	6
	3.05A		5	6	6	7	7
RED	0.25A	2	2	2	2	2	2
	0.55A	2	2	3	3	3	3
	0.77A	3	3	3	3	3	4
	1.15A	4	3	4	4	4	4
	2.03A	4	4	4	5	5	5
	3.05A		4	5	5	5	5
GREEN	0.25A	2	2	2	2	2	2
	0.55A	2	2	3	3	3	3
	0.77A	3	3	3	3	3	4
	1.15A	3	4	4	4	4	4
	2.03A	4	4	4	5	5	5
	3.05A		4	5	5	5	5

LAMP CURRENT RATING (AMP)	0.25	0.55	0.77	1.15	2.03	3.05
VERTICAL DIVERGENCE (DEG)						
50% BEAM WIDTH	±1.7	±2.1	±2.6	±2.6	±2.5	±2.5
15% BEAM WIDTH	±2.2	±3.7	±3.7	±3.9	±3.8	±2.5

NOTE: Consult the Visual Signal Design Manual for intensities.

Data Sheet 6-E(14). (cont'd).

Dimensions. The dimensions of the 200mm buoy lantern are illustrated in figure 6-24. The older version of the lantern is slightly shorter, and has a base with four equally spaced mounting slots, rather than six slots for either 3 or 4 point mounting. In either case, use only three bolts to mount the lantern. The overall weight of the 200mm buoy lantern is 30 lbs. (13.5 kg).

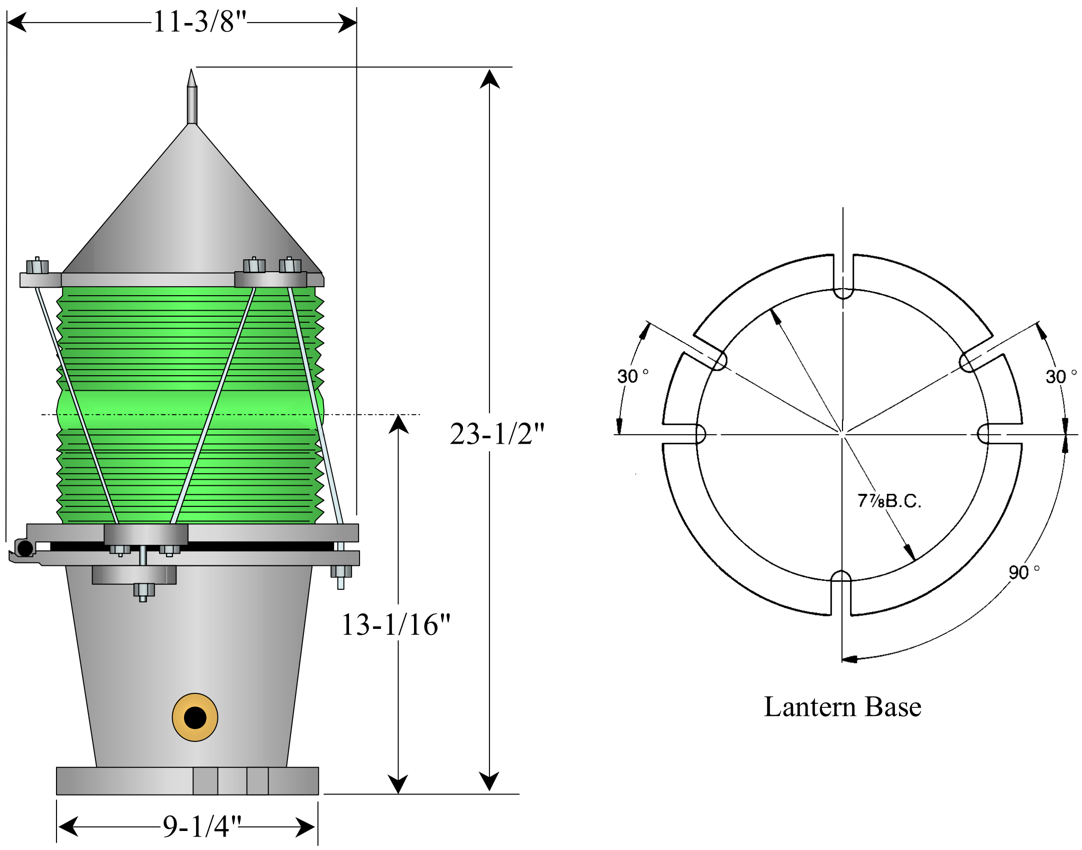


Figure 6-24. 200mm Buoy Lantern Dimensions and Base

Data Sheet 6-E(14). (cont'd).

Additional Data. The 200mm lantern and parts are commercially available from Automatic Power, Inc., (713) 228-5208. The only parts that are compatible with the old style 200mm are the lens and gaskets. The lampchanger bracket for the 200mm buoy lantern has a much deeper "dip" than the bracket used in the 155mm lantern, as illustrated in figure 6-25.

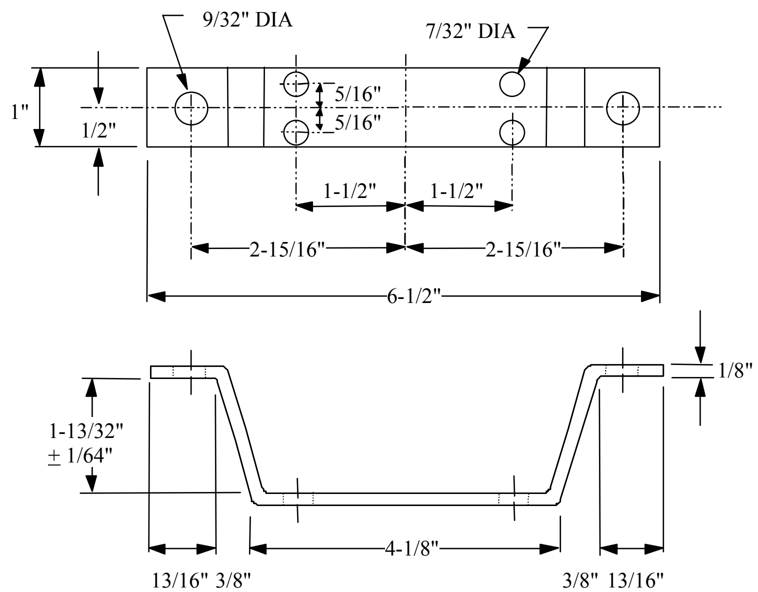


Figure 6-25. Lampchanger Bracket for 200mm Buoy Lantern.

Data Sheet 6-E(14). (cont'd).

6.E.

250mm Marine Signal Lantern

Function. The 250mm lantern is for use only on stable platforms. It shall not be used on buoys or on wooden single pile beacons located in the water. It may be installed on steel or concrete beacon structures in a hard bottom and not subject to collisions. Omnidirectional nominal ranges of up to 9 nm can be obtained with the standard 12VDC equipment.

Features.

- Optional color sectors.
- Condensing panels and reflex reflectors available for higher intensity pencil beams.
- Requires precision focusing and leveling.
- Requires azimuth sighting of beams and sectors.
- Replaceable clear, green, red, or yellow acrylic lens covers.
- Vented version for use with 120-volt lamps can dissipate 200 watts of heat continuously.
- Standard version can dissipate 75 watts of heat continuously.
- Aluminum base with four 1/16-in. drain holes.

Related Equipment. The 250mm marine signal lantern may be equipped with either standard 12VDC equipment, including 12-volt lamps, CG-6P lampchanger, CG-181/493 flasher, daylight control, and WK-681 wiring kit; or 120VAC equipment. Lanterns outfitted for 120VAC power are outfitted with an FLAC-300 flasher and CG-4P lampchanger. A Type L daylight control is used if the aid is to be daylight controlled. Only the 120-volt, 250 watt lamp may be used in the 250mm lantern with the CG-4P.

Data Sheet 6-E(15). 250mm Marine Signal Lantern

6.E.

Wiring.

a. 12-Volt Operation:

(1) The basic procedures for wiring the 250mm lantern for 12VDC operation are the same as those for the 155mm buoy lantern. The lampchanger bracket is considerably different, however, as illustrated in figure 6-26. When viewed from the top, the mounting bracket goes under the mounting ring.

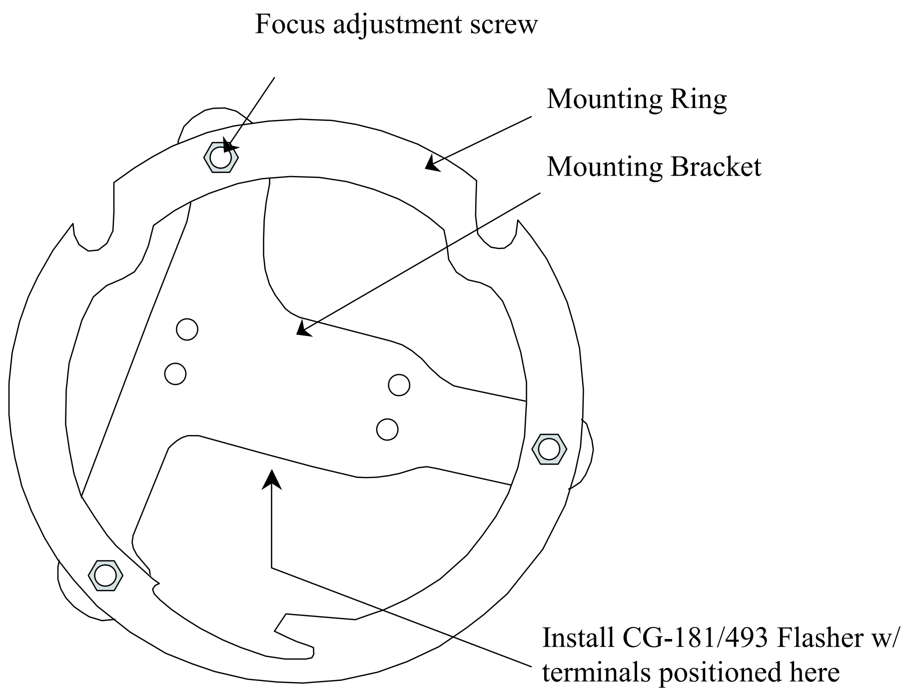


Figure 6-26. Lampchanger Bracket for 250mm Marine Signal Lantern (12VDC).

(2) The leads from the WK-681 wiring kit must be passed between the mounting ring and the mounting bracket when the CG-181/493 flasher and CG-6P lampchanger are wired together. For flashing light signals, install the Type R or Type C daylight control, as appropriate. For fixed-on light signals, a Type L daylight control will be used.

(3) Install a focus fixture in the first position of the lampchanger, and secure the lampchanger/flasher assembly to the three support arms in the lantern base. The ¾" spacers must go UNDER the mounting ring, as illustrated in figure 6-27.

(4) Install the power leads. Terminate the leads with spade lugs and attach to the CG-181/493 flasher input terminals.

Data Sheet 6-E(15). (cont'd).

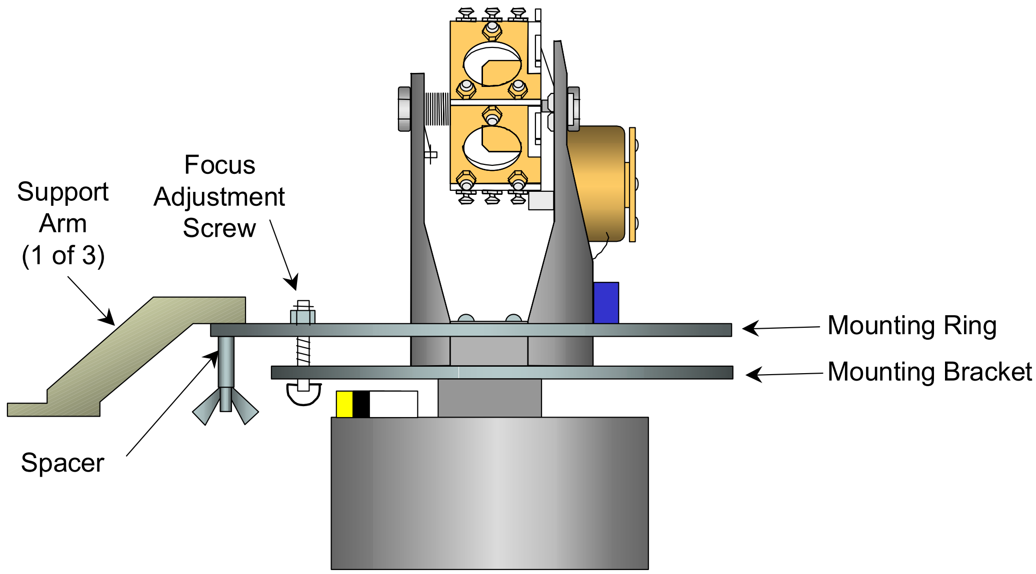


Figure 6-27. Mounting 12VDC Lampchanger/Flasher Assembly in 250mm Lantern.

b. 120-Volt Operation. **USE EXTREME CAUTION WHEN INSTALLING, TESTING, OR SERVICING UNITS WITH 120VAC POWER.**

(1) The mounting bracket must be modified to hold the FLAC-300 flasher. Scribe two lines connecting opposing lampchanger mounting holes. Drill a $^1/_4$" hole at the intersection to mount the FLAC-300 with an 8-32x$^5/_{16}$" screw, as illustrated in figure 6-28.

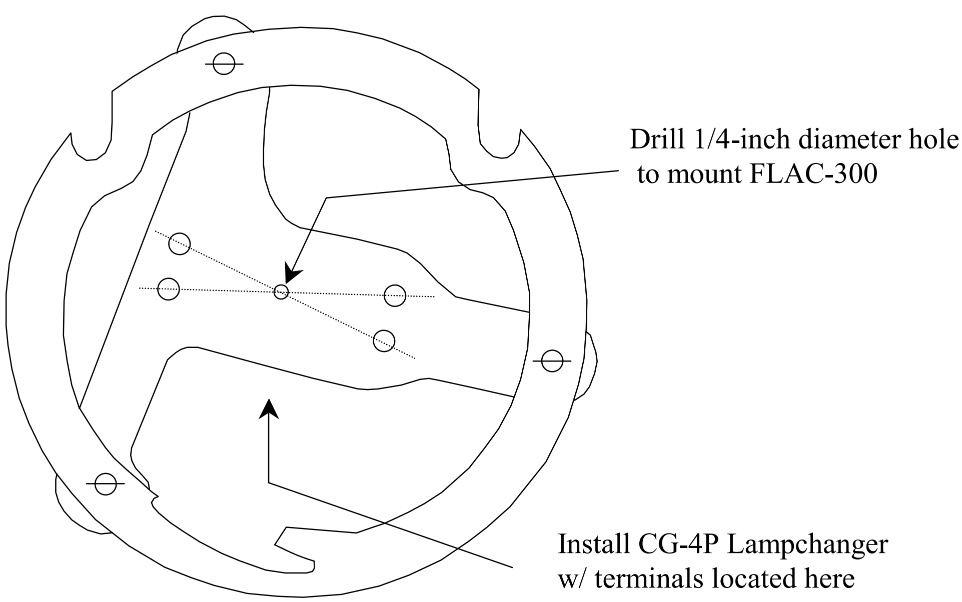


Figure 6-28. Lampchanger Bracket for 250mm Marine Signal Lantern (120VAC).

Data Sheet 6-E(15). (cont'd).

(2) Mount the CG-4P lampchanger to the mounting bracket using the four 10-32x½" screws supplied with the lampchanger.
(3) Install a 120-volt, 250 watt focus fixture in the first position of the lampchanger, and secure the lampchanger/flasher assembly to the three support arms in the lantern base. The ¾" spacers must go OVER the mounting ring, as illustrated in figure 6-29. (The FLAC-300 flasher is omitted for clarity.)
(4) Install the power leads. Wire the CG-4P lampchanger, FLAC-300 flasher and daylight control as outlined in Data Sheet 6-E(8).

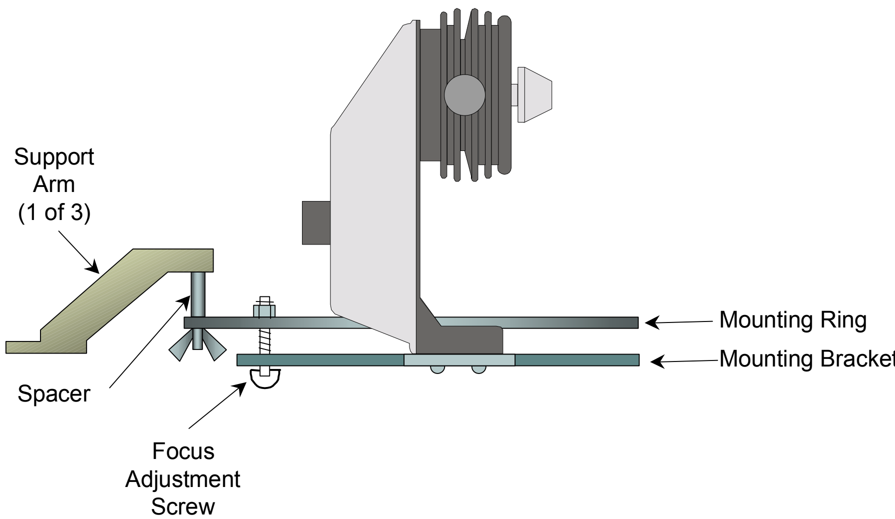


Figure 6-29. Mounting 120VAC Lampchanger in 250mm Lantern.

Installation. The 250mm marine signal lantern shall not be installed on wooden, single pile structures in the water. Installation on other structures is permitted, provided that the structure is not prone to excessive tilting (greater than 1 degree) due to winds or currents. The 250mm lantern has four 2" x 7/16" mounting slots, equally spaced around a 7-7/8" bolt circle (see figure 6-32). Use only three of the four mounting slots to install the lantern. The basic procedures for installing the 250mm lantern are the same as those outlined for installation of a 155mm buoy lantern on a structure (see Data Sheet 6-E(13)).

Focusing. The 250mm marine signal lantern requires precise focusing. The focus should be checked upon initial installation, when the flasher, lampchanger, or lampchanger bracket are changed, and whenever the optic is relamped. The 250mm lens has four sighting marks: two adjacent clear circles with two opposing circles engraved with an “X.”

(1) Loosen all the screws on the lens-clamping ring.
(2) With the lantern open, look through the lens. Align one of the clear sighting marks with the focus adjustment screw on the long arm of the mounting bracket (see figure 6-30).
(3) Tighten the screws on the lens-clamping ring.

Data Sheet 6-E(15). (cont’d).

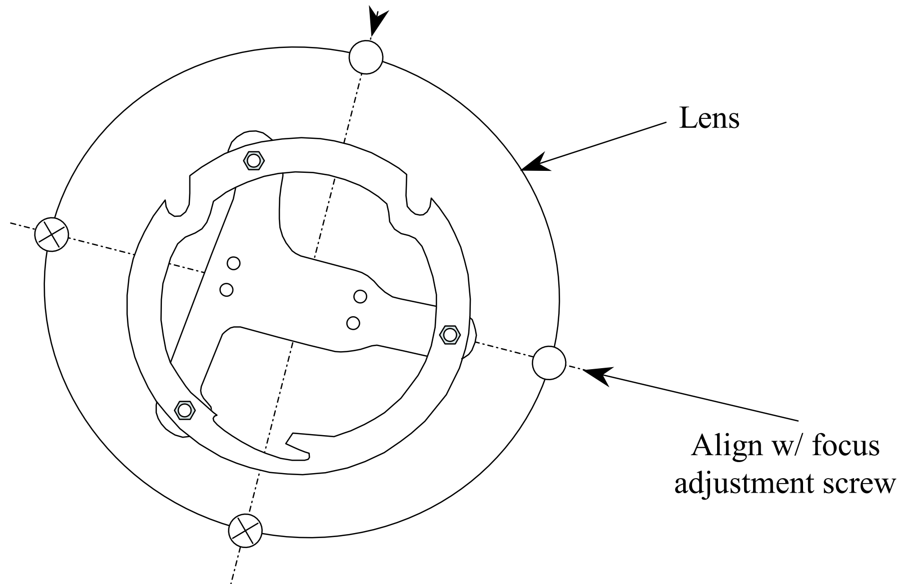


Figure 6-30. Alignment of Sighting Mark and Focus Adjustment Screw—250mm Lantern.

(4) Secure the lampchanger/flasher assembly to the support arms. Insure that the spacers are on the appropriate side of the mounting ring.

(5) Tighten the focus adjustment screws on the mounting bracket by turning the "D" rings **COUNTER-CLOCKWISE** until the mounting bracket is tight against the mounting ring.

(6) Turn each of the focus adjustment screws **CLOCKWISE** six (6) complete revolutions. Close the lantern, but do not secure the lens assembly to the base.

(7) Look through the clear sighting mark that was aligned with the focus adjustment screw in step (2), above. Initially, the focus fixture should be slightly below the center of the rear sighting mark. If the focus fixture is too high, turn all the focus adjustment screws the same amount to lower the focus fixture. If the focus fixture is to the right or left of the center of the rear sighting mark, use the remaining two focus adjustment screws to align the focus fixture.

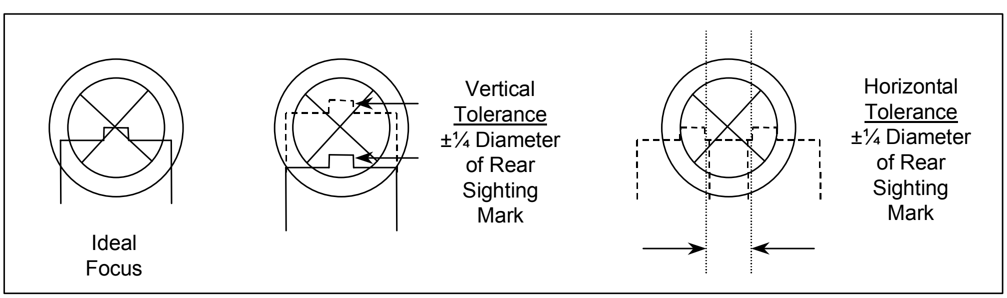


Figure 6-31. Focus Picture for 250mm Marine Signal Lantern.

(8) Look through the second clear sighting mark, and use the focus adjustment screw that was aligned with the first sighting mark to center the focus fixture.

Data Sheet 6-E(15). (cont'd).

(9) Repeat steps (7) and (8) as necessary, until the focus fixture is centered in both sight pictures. Note, the focus fixture may still be slightly below the ideal focus position.
(10) Turn all the focus adjustment screws the same amount, to center the focus fixture in the sight pictures, if necessary.
(11) If unable to obtain an ideal focus, check for improper mounting/spacer position, bent mounting ring, bracket, etc. Replace any damaged items and repeat the procedures.
(12) Remove the lampchanger/flasher assembly by loosening the three wing nuts on the support arms. **DO NOT TURN THE "D" RINGS ON THE MOUNTING BRACKET**.
(13) Remove the focus fixture, and place the appropriate lamps in the lampchanger. Remember, only the 250-watt lamp may be used in the 250mm lantern, when outfitted with 120VAC equipment.
(14) Reinstall the lampchanger/flasher assembly in the lantern, and secure the lens assembly to the base.

<u>Performance Characteristics</u>. The performance characteristics of the 250mm marine signal lantern with 12-volt lamps and the 120-volt, 250 watt lamp are provided in Table 6-9.

The tabulated values for condensing panel intensity are at the center of the beam created by the condensing panel. The full width (to 50% intensity) of the beam is 1.5 degrees. At ±3 degrees of the beam axis, the intensities fall to 150% of the standard values. From 3 degrees to 30 degrees on either side of the beam axis, the intensities fall to 50% of the standard values. When a reflex reflector is used opposite of the condensing panel, the intensities are increased by 20%.

Data Sheet 6-E(15). (cont'd).

Table 6-9
250mm Marine Signal Lantern Performance

NOMINAL RANGES (NMI) – 250 MM LANTERN (ACRYLIC LENS)

LENS	LAMP 12V	FL 2.5(0.3) FL (2+1) 6 Q	FL 4(0.4) FL (2) 5 Mo (A) (0.4, 2.0)	FL 6(0.6)	FL (2) 6 FL 2.5(1) ISO 2	ISO 6 OCC 4	FIX
CLEAR	0.25A	4	4	4	5	5	5
	0.55A	5	6	6	6	6	6
	0.77A	6	6	6	7	7	7
	1.15A	6	7	7	7	8	8
	2.03A	7	8	8	8	9	9
	3.05A		8	9	9	9	10
120V	250W	10	11	12	12	12	12
YELLOW	0.25A	4	4	4	4	4	4
	0.55A	5	5	5	5	6	6
	0.77A	5	6	6	6	6	6
	1.15A	6	6	6	7	7	7
	2.03A	7	7	7	8	8	8
	3.05A		7	8	8	9	9
120V	250W	10	10	11	11	12	12
RED	0.25A	3	3	3	3	3	3
	0.55A	4	4	4	4	4	5
	0.77A	4	4	5	5	5	5
	1.15A	5	5	5	5	6	6
	2.03A	5	6	6	6	7	7
	3.05A		6	6	7	7	7
120V	250W	8	9	9	10	10	10
GREEN	0.25A	3	3	3	3	3	3
	0.55A	4	4	4	4	4	4
	0.77A	4	4	5	5	5	5
	1.15A	5	5	5	5	6	6
	2.03A	5	6	6	6	7	7
	3.05A		6	6	7	7	7
120V	250W	8	9	9	10	10	10

	12V LAMP CURRENT RATING (AMPS)						120V
	0.25	0.55	0.77	1.15	2.03	3.05	250W
Vertical divergence (degrees)							
50% beam width	±1.0	±1.1	±1.4	±1.6	±1.5	±1.7	±3.2
15% beam width	±1.5	±1.7	±1.9	±2.2	±2.0	±2.3	±4.5
Condensing panel intensity (cd)							
clear lens (fixed rhythm)	850	1,800	4,000	5,500	9,000	11,000	50,000
red/green lens (fixed rhythm)	260	560	1,200	1,700	2,800	3,400	16,000
yellow lens (fixed rhythm)	600	1,300	2,800	3,900	6,400	7,800	36,000

Note: Consult the Visual Signal Design Manual for intensities

Data Sheet 6-E(15). (cont'd).

Dimensions. The dimensions of the 250mm marine signal lantern are illustrated in figure 6-32. The overall weight of the lantern is 14.5 lbs.

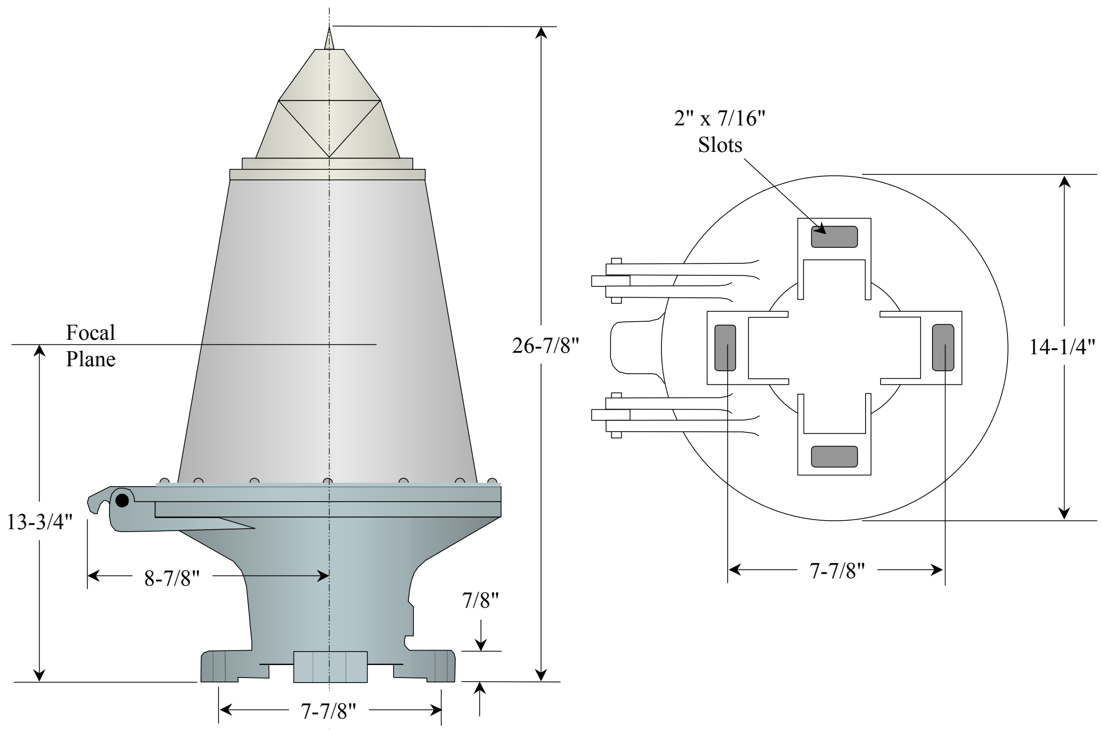


Figure 6-32. 250mm Marine Signal Lantern Dimensions and Base.

Additional Data. The 250mm marine signal lantern and components may be purchased as commercial items from Automatic Power, Inc. (API), (713) 228-5208. The lens assembly consists of an omnidirectional drum lens and a lens cover with an integral bird spike. The drum lens is open at the top, to permit air circulation. The lens cover has a smooth surface, reducing dirt accumulation. The lens cover comes in clear, red, green and yellow, and may be *sectored* to provide different colored regions of light output. Additional options include condensing panels, reflex reflectors, and a vented lens cover (see figures 6-33, 6-34, and 6-35, respectively).

- The condensing panel, shown in figure 6-33, is 60 degrees wide and two-thirds the drum lens height. It fits between the drum lens and the lens cover, with teeth base down on the lens support ring. The lens cover is positioned so that one of the five teeth on the inside of the cover engages the center tooth space of the condensing panel. The condensing panel collects the light emitted by the drum lens over a 60-degree arc, and compresses it into a 3 degree (full width at half maximum) pencil beam, as indicated in Table 6-9. When the 250mm lantern with condensing panel is used as a range lantern, the beam must be accurately aligned with the channel centerline. The National Aids to Navigation School provides a handout, “True South Finder Construction and Use,” that is beneficial in aligning the condensing panel with the channel centerline. (Note, final alignment of range lights should always be checked by a unit at the far end of the channel.)

Data Sheet 6-E(15). (cont’d).

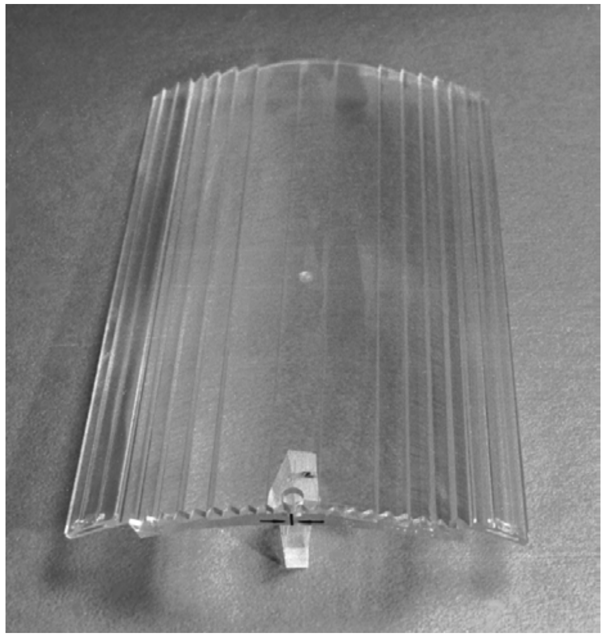


Figure 6-33. Condensing Panel for 250mm Marine Signal Lantern.

- The reflex reflector, shown in figure 6-34, fits inside the drum lens, and reflects the light over a 60-degree arc towards the opposite side of the lantern. The output over the 60-degree sector opposite the reflex reflector is increased by approximately 30%. When used with a condensing panel, the peak intensity of the pencil beam emitted by the condensing panel is increased by approximately 20%.

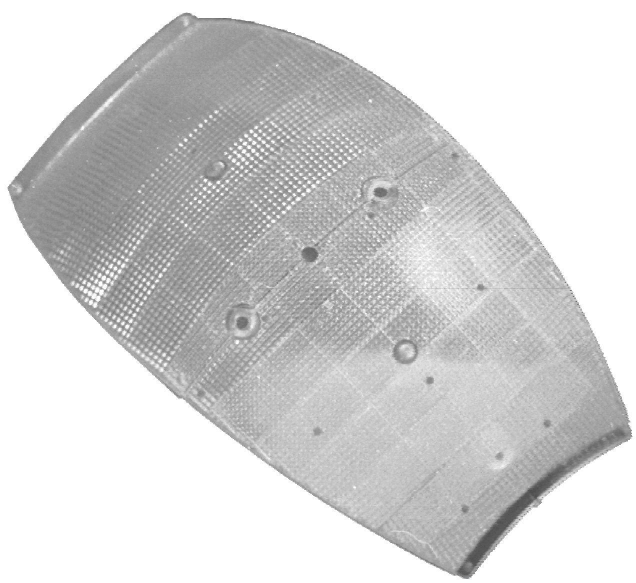


Figure 6-34. Reflex Reflector for 250mm Marine Signal Lantern.

Data Sheet 6-E(15). (cont'd).

6.E.

- The standard 250mm lantern is capable of dissipating the equivalent of a continuous lamp-load of 75 watts. A vented 250mm lantern can dissipate the equivalent of 200 watts. Therefore, the vented 250mm lantern must be used with the 120-volt, 250 watt lamp, when the lamp is operated with a duty cycle equal to or greater than 30%, but is restricted to a duty cycle no greater than 80%. The vented lens cover assembly, illustrated in figure 6-35, is commercially available from API.

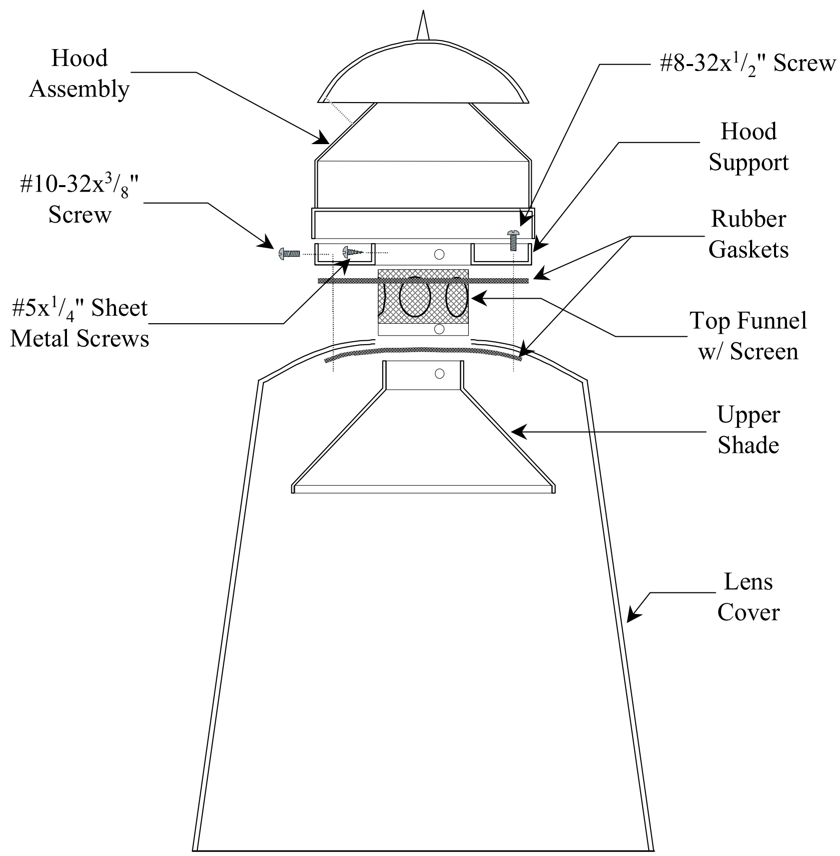


Figure 6-35. Vented Lens Cover Assembly for 250mm Marine Signal Lantern

Data Sheet 6-E(15). (cont'd).

6.E.

300mm Marine Signal Lantern

Function. The 300mm marine signal lantern is used only on stable platforms. It shall not be used on buoys and wooden single-pile structures located in the water. It may be installed on steel or concrete beacon structures in a hard bottom and not subject to collisions. Omnidirectional nominal ranges of up to 10nm can be obtained with standard 12VAC equipment.

Features.

- Requires precision focusing and leveling
- Replaceable clear, green, red, or yellow acrylic lens
- Can dissipate 250 watts of heat continuously
- Plastic base with four 1/16-in. drain holes.

Related Equipment. The 300mm marine signal lantern may be equipped with either standard 12VDC equipment, including 12-volt lamps (including the 12-volt, 100 and 110 watt tungsten-halogen lamps), CG-6P/CG-6PHW lampchanger, CG-181/493/CG-481 flasher, daylight control, and WK-681 wiring kit; or 120VAC equipment. Lanterns outfitted for 120VAC power burning fixed-on 24-hours per day use a CG-4P lampchanger. For fixed-on lanterns that are daylight controlled, use a Type K daylight control and CG-4P. For flashing lights, install an FLAC-300 flasher, Type L daylight control, and CG-4P lampchanger. Only the 120-volt, 250 watt lamp may be used in the 250mm lantern with the CG-4P. The 300mm lantern comes with a focus lens, which must be used to accurately focus the lantern.

Data Sheet 6-E(16). 300mm Marine Signal Lantern

6.E.

Wiring.

a. 12-Volt Operation: Wiring conventions are the same as those followed for the 155mm lantern. The size of the power leads will depend on the length of the wire run, and the rated current draw of the lamp. The lampchanger bracket is the same as that used with the 155mm lantern.

  (1) Wire a CG-6P lampchanger and CG-181/493 flasher together, following the procedures in data sheet 6-E(6).
  (2) Attach the lampchanger/flasher assembly to the 300mm tripod, shown in figure 6-36, by turning the assembly onto the studs on the elevated mounting pads. Tighten the wing nuts. Install a focus fixture in the first position of the lampchanger.
  (3) Install the power leads to the lantern. Terminate the leads with spade lugs and attach to the flasher's input terminals.
  (4) Install the tripod into the lantern by aligning the opposing triangles on the tripod and the focus ring, as illustrated in figure 6-37. Tighten the wing nuts to secure.

Figure 6-36. 300mm Tripod.

Figure 6-37. 300mm Focus Ring with Tripod (Lampchanger/Flasher omitted for clarity).

b. 120-Volt Operation: There are two lampchanger brackets that may be used when the 300mm lantern is outfitted for 120VAC operation. The older version has an angled center section, and is slightly deeper than the bracket used for 12VDC operation, while the newer version has the same outline as the 155mm bracket but the "dip" is ¾" deeper. The older version is pre-drilled to mount an FLAC-300 flasher, if used, and fits on the lower mounting pads of the 300mm tripod. The newer bracket must be modified to mount the FLAC-300 flasher. Scribe two lines connecting opposing lampchanger mounting holes. Drill a ⅜" hole at the intersection to mount the FLAC-300 with an 8-32x$^{5}/_{16}$" screw. The newer bracket is mounted on the elevated mounting pads.

Data Sheet 6-E(16). (cont'd).

(1) Mount a CG-4P to the lampchanger bracket, with the “dip” down and install a 120-volt, 250 watt focus fixture in the first position of the lampchanger. If an FLAC-300 is to be used, mount it to the lampchanger bracket with an 8-32x$^{5}/_{16}$" screw through the center hole of the bracket.
(2) Attach the lampchanger/flasher assembly to the 300mm tripod (see figure 6-36) by turning the assembly onto the studs on the appropriate mounting pads, depending on the lampchanger bracket that is used. Tighten the lock nuts.
(3) Install the power leads to the lantern. Wire the CG-4P lampchanger, FLAC-300 flasher (if used) and daylight control as outlined in Data Sheet 6-E(8).
(4) Install the tripod into the lantern by aligning the opposing triangles on the tripod and the focus ring (see figure 6-37). Tighten the wing nuts to secure.

<u>Installation</u>. The 300mm marine signal lantern shall not be installed on wooden, single pile structures in the water. Installation on other structures is permitted, provided that the structure is not prone to excessive tilting (greater than 1 degree) due to winds or currents. The 300mm lantern has provisions for three or four 1" x 5/8" mounting slots, equally spaced around a 7-7/8" bolt circle (see figure 6-32). Use three equally spaced mounting slots to install the lantern. The basic procedures for installing the 300mm lantern are the same as those outlined for installation of a 155mm buoy lantern on a structure (see Data Sheet 6-E(13)).

<u>Focusing</u>. The 300mm marine signal lantern requires precise focusing. The focus should be checked upon initial installation, when the flasher, lampchanger, or lampchanger bracket are changed, and whenever the optic is relamped. The 300mm lens has four black dots that serve as the sighting marks. A focus lens (or prism) comes with the lantern to assist in focusing.

(1) Loosen all the screws on the lens-clamping ring.
(2) With the lantern open, look through the lens. Align one of the sighting marks with one of the focus adjustment screws. Tighten the screws on the lens-clamping ring.
(3) Tighten the focus adjustment screws on the mounting ring **CLOCKWISE** until tight against the lens support ring.
(4) Turn each focus adjustment screw **COUNTER-CLOCKWISE** nine (9) complete revolutions. Close the lantern, but do not secure the lens assembly to the base.
(5) Look through the sighting mark that was aligned with the focus adjustment screw in step (2), above, using the focus prism. If done with your eye close to the lantern, the front sighting mark will become a fuzzy black “halo,” and the rear sighting mark should be visible in the center. If done with your eye about nine inches back from the lantern, the rear sighting mark will be occluded by the front sighting mark. Move your head slightly from side to side and up and down to insure the two marks are aligned. Initially, the focus fixture should be slightly below the center of the rear sighting mark. If the focus fixture is too high, turn all the focus adjustment screws the same amount to lower the focus fixture. If the focus fixture is to the right or left of the center of the rear sighting mark, use the remaining two focus adjustment screws to align the focus fixture.

Data Sheet 6-E(16). (cont’d).

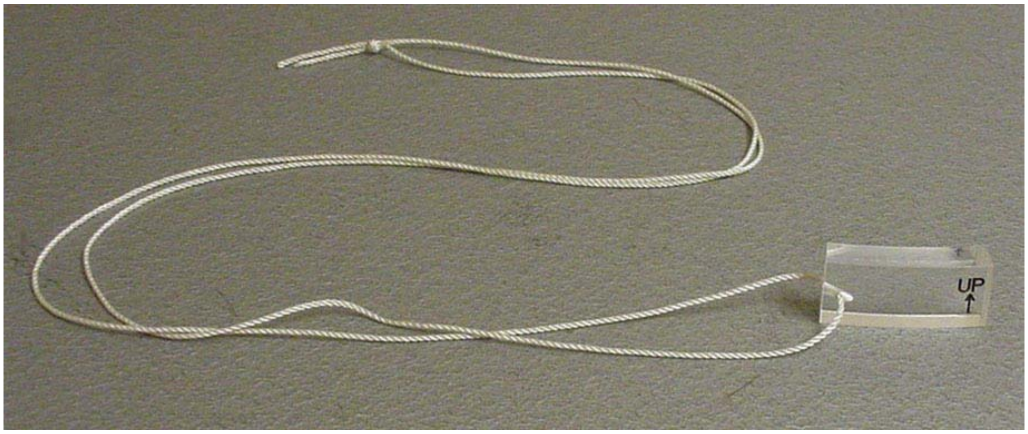


Figure 6-38. Focus Lens for the 300mm Lantern.

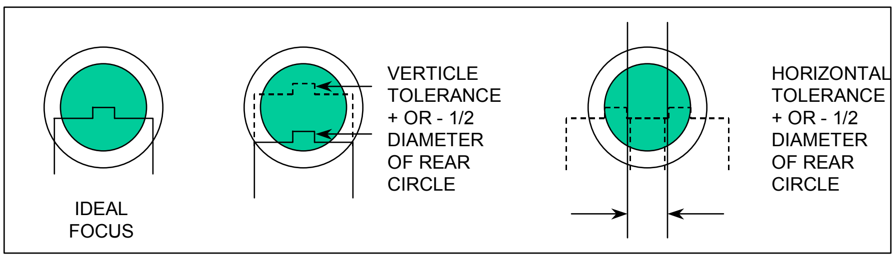


Figure 6-39. Focus Picture for 300mm Marine Signal Lantern.

(6) Look through the second set of sighting marks, and use the focus adjustment screw that was aligned with the first sighting mark to center the focus fixture.
(7) Repeat steps (5) and (6) as necessary, until the focus fixture is centered in both sight pictures. Note, the focus fixture may still be slightly below the ideal focus position.
(8) Turn all the focus adjustment screws the same amount, to center the focus fixture in the sight pictures, if necessary.
(9) If unable to obtain an ideal focus, check for improper mounting/lampchanger bracket, bent bracket, etc. Replace any damaged items and repeat the procedures.
(10) Remove the lampchanger/flasher assembly by loosening the three wing nuts on the mounting ring. **DO NOT TURN THE FOCUS ADJUSTMENT SCREWS ON THE MOUNTING RING.**
(11) Remove the focus fixture, and place the appropriate lamps in the lampchanger. Remember, only the 250-watt lamp may be used in the 300mm lantern, when outfitted with 120-volt equipment.
(12) Reinstall the lampchanger/flasher assembly in the lantern, and secure the lens assembly to the base.

Performance Characteristics. The performance characteristics of the 300mm marine signal lantern with 12-volt lamps and the 120-volt, 250-watt lamp are provided in Table 6-10.

6.E.

Table 6-10
300mm Marine Signal Lantern Performance

NOMINAL RANGES (NMI) – 300 MM LANTERN (ACRYLIC LENS)

LENS	LAMP 12V	FL 2.5(0.3) FL (2+1) 6 Q	FL 4(0.4) FL (2) 5 Mo (A) (0.4, 2.0)	FL 6(0.6)	FL (2) 6 FL 2.5(1) ISO 2	ISO 6 OCC 4	FIXED
	0.25A	5	5	5	5	5	5
	0.55A	6	6	6	7	7	7
CLEAR	0.77A	6	7	7	7	8	8
	1.15A	7	7	8	8	8	8
	2.03A	8	8	9	9	9	10
	3.05A		9	9	10	10	10
120V	250W	11	12	12	13	13	13
	0.25A	4	4	4	5	5	5
	0.55A	5	5	6	6	6	6
YELLOW	0.77A	6	6	6	7	7	7
	1.15A	6	6	7	7	7	7
	2.03A	7	7	8	8	8	9
	3.05A		8	8	9	9	9
120V	250W	10	11	11	12	12	12
	0.25A	3	3	3	4	4	4
	0.55A	4	4	4	5	5	5
RED	0.77A	5	5	5	5	5	5
	1.15A	5	5	6	6	6	6
	2.03A	5	6	6	7	7	7
	3.05A		6	7	7	8	8
120V	250W	9	9	10	10	10	11
	0.25A	3	3	3	4	4	4
	0.55A	4	4	4	5	5	5
GREEN	0.77A	5	5	5	5	5	6
	1.15A	5	5	6	6	6	6
	2.03A	5	6	6	7	7	7
	3.05A		6	7	7	8	8
120V	250W	9	9	10	10	10	11

	12V lamp current rating (amps)						120V
	0.25	0.55	0.77	1.15	2.03	3.05	250W
Vertical divergence (degrees)							
50% beam width	±1.2	±1.0	±0.9	±1.1	±1.3	±1.5	±2.5
15% beam width	±1.5	±1.5	±1.2	±1.4	±1.8	±2.1	±3.4

Note: Consult the Visual Signal Design Manual for intensities.

Data Sheet 6-E(16). (cont'd).

Dimensions. The dimensions of the 300mm marine signal lantern are illustrated in figure 6-40. The overall weight of the lantern is 19 lbs. (8.7kg).

Additional Data. The 300mm marine signal lantern and components may be purchased as commercial items from Tideland Signal Corp., (713) 681-6101. The lens assembly is a single piece of cast acrylic, with an integral bird spike. The lens comes in clear, green, red and yellow transmissive colors. The 300mm lantern is capable of dissipating the equivalent of a continuous lamp-load of 250 watts. Thus, the 120-volt, 250 watt lamp may be operated fixed-on in the 300mm lantern.

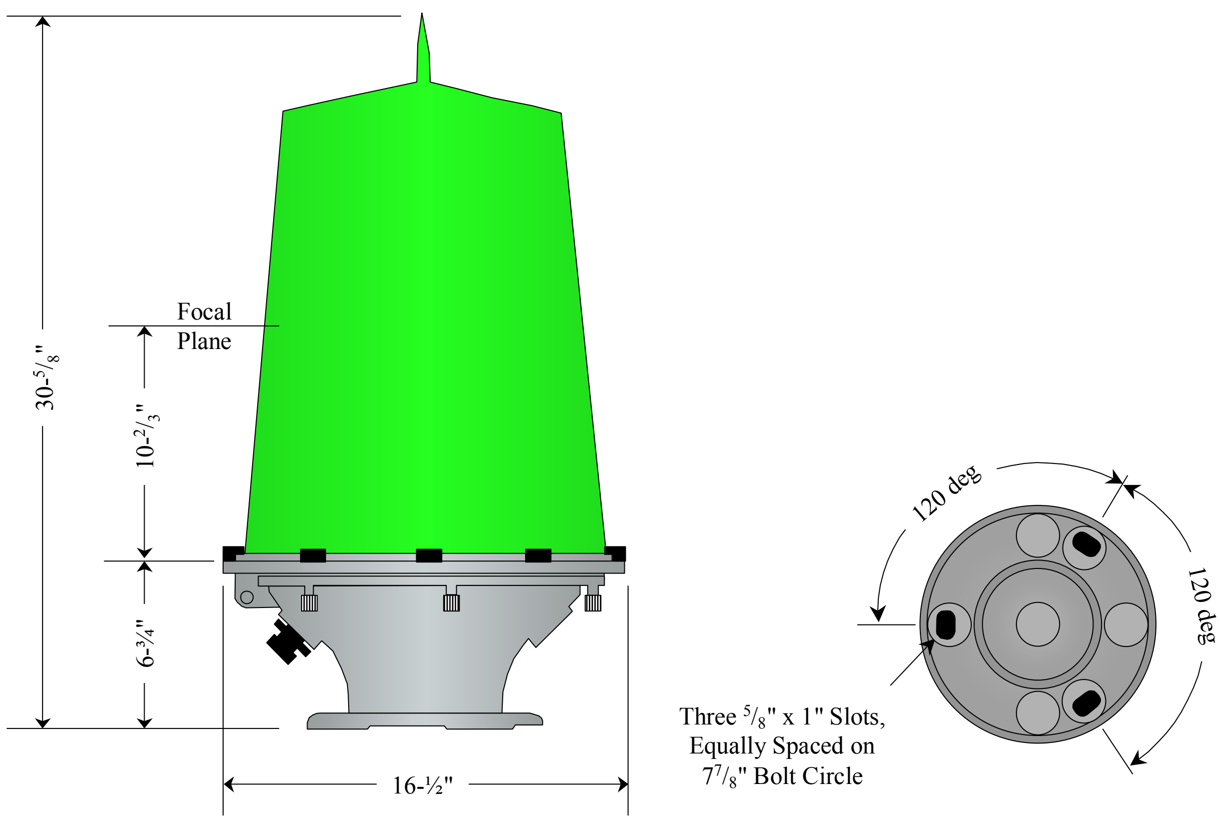


Figure 6-40. 300mm Marine Signal Lantern Dimensions and Base.

Data Sheet 6-E(16). (cont'd).

VRB-25 Rotating Beacon

Function. The VRB-25 rotating beacon is the standard beacon for use when commercial power is not available, and when the required luminous intensity for a white or colored light signal exceeds 6,000 or 1,400 cd, respectively, or when an alternating characteristic is required. The VRB-25 rotating beacon may only be used on structures not subjected to noticeable vibrations.

Features.

- Constructed of corrosion resistant aluminum, anodized, with 2-part polyurethane paint on external surfaces.
- Requires precision focusing and leveling
- Replaceable clear, green, or red lenses and blanking panels.
- Uses all 12-volt marine signal lamps, up to and including the 110 watt lamp.
- Speed range of 2/3 to 15.9 rpm; user selectable. Speed tolerance is ±2%.
- Requires a vibration-free platform.
- Replaces the 190mm rotating beacon.
- May be configured for internal or external control.

Data Sheet 6-E(17). VRB-25 Rotating Beacon.

Electrical Characteristics.

- Operating voltage:.........12VDC nominal; 11 to 18VDC allowable.
- Motor Controller:..........Universal Vega type (CALC20), built in.
- Drive Motor: ....12VDC, three-phase, electronically-commutated, ...twenty-pole, direct drive motor.
- Power Consumption:.....Less than 0.10 amps at 12VDC (not including lamp). ....Drive motor operates 24-hours per day.

Operating Characteristics.

- Lens Options: ....Clear, Red, Green, and Blanking Panels.
- Character Sets: ....Flashing, Alternating, Group Flash (up to Group Flash 4).
- Effective Intensity: ....See the Visual Signal Design Manual.
- Nominal Range: ....Maximum of 22nm. (See Tables 6-11, 6-12, and 6-13 for ....specific capabilities with various lamps and at various rotation ....rates for clear, green, and red lenses, respectively.)
- Beam Patterns: ....See figure 6-41.

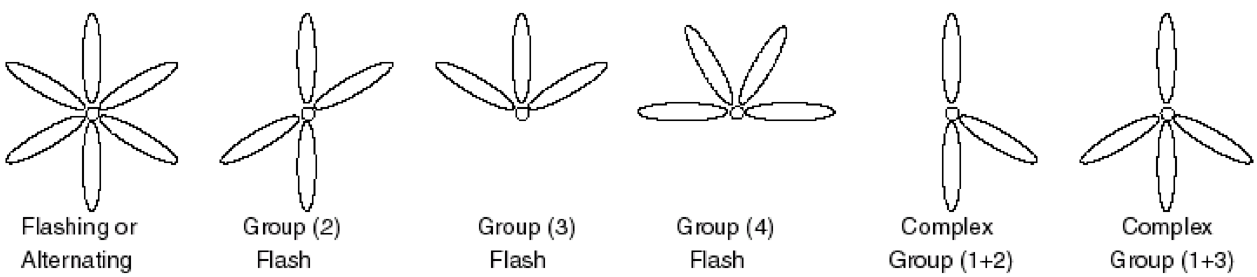


Figure 6-41. Possible Beam Patterns for VRB-25 Rotating Beacon.

Rotation Speed. Rotation rate for a given characteristic may be determined by the following formula:

$$\text{Rotation rate} = \frac{1\ \text{Rev}}{6\ \text{Flashes}} * \frac{1\ \text{Flash}}{\text{Interval (sec)}} * \frac{60\ \text{sec}}{1\ \text{min}} = \text{rpm}$$

Where the *Interval* is the period between flashes of the characteristic

Related Equipment. The VRB-25 rotating beacon must be equipped with 12-volt lamps and a six-place lampchanger. The beacon may be wired for *internal control*, with a flasher and Type L daylight control installed, or may be used in conjunction with an SDB and SAC II (*external control*).

Wiring and Hardware Configurations—Internal Control. Figure 6-42 illustrates the basic wiring schematic for the internally-controlled VRB-25 rotating beacon. (Note: the Lampchanger Plate is not shown.) Selection of standard or high-wattage versions of the six-place lampchanger and 12VDC flasher depend on the lamp that will be used. The euro-style terminals on the beacon Terminal Plate will allow for wire size up to 10AWG.

Data Sheet 6-E(17). (cont'd).

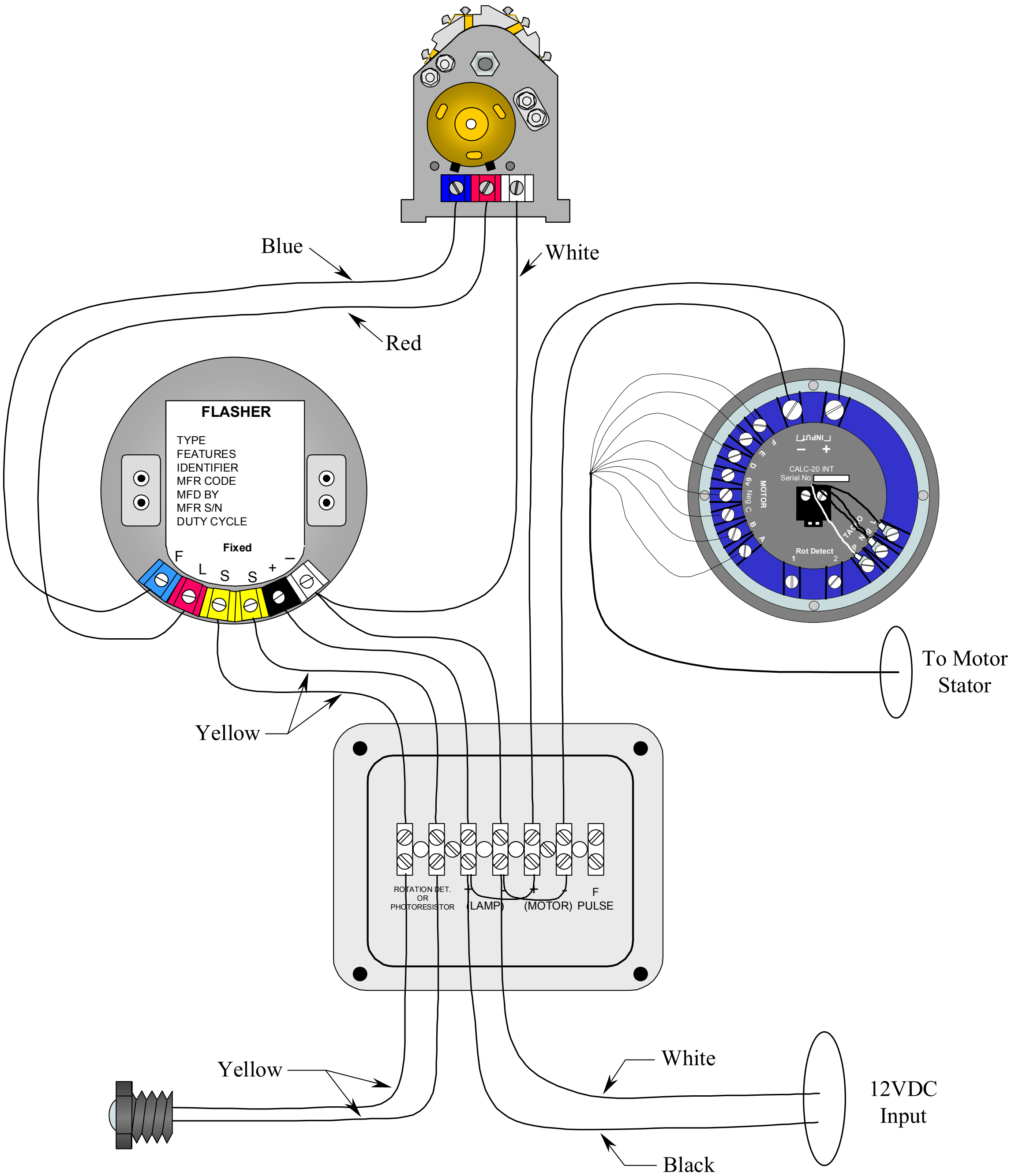


Figure 6-42. Wiring Diagram for VRB-25 Rotating Beacon (Internal Control).

(1) Unscrew the four capscrews that secure the Terminal Plate to the beacon base and remove the Terminal Plate from the beacon. Remove the two rotation detection leads and tape them off, they will not be used.

Data Sheet 6-E(17). (cont'd).

(2) Insert the power cable through the cable gland. Strip ¼ inch of insulation from the ends of each lead and secure to the Lamp (+) and (-) terminals. Secure the cable gland.
(3) Jumper the Lamp (+) input to the Motor (+) input on the terminal strip.
(4) Jumper the Lamp (-) input to the Motor (-) input on the terminal strip.
(5) Screw a Type L daylight control into the ¾" NPT opening. Secure the two leads from the daylight control to the Photoresistor Input terminals on the terminal strip. The lugs will need to be cut off, and ¼" of insulation stripped from the ends on the leads. (The leads may be shortened, if desired.)
(6) Release the eight Thumb Latches located on the lower ring of the Glazing Assembly by rotating 180°. Carefully lift the assembly from the beacon.
(7) Looking down into the beacon, remove the capscrews securing the Lampchanger Plate to the Flasher Housing, and remove the plate. (Leave the three springs that surround the capscrews in place.)
(8) Wire a CG-6P/CG-6PHW lampchanger with a WK-681 wiring kit. After securing the wires to the lampchanger terminals, bend the lugs out approximately 90°.
(9) Secure the other end of the wiring kit to a CG-181/CG-481 flasher, with the lugs on the inside.
(10) Orient the lampchanger on top of the Lampchanger Plate so that the terminal strip faces AWAY from the opening of the plate, and the flasher below the plate so that its terminal strip is visible under the Lampchanger Plate opening.
(11) Secure the lampchanger and flasher to the Lampchanger Plate with four 10-32x1" stainless steel screws.
(12) Wire the flasher with one each black and white lamp power leads, and two 18AWG yellow daylight control leads. The leads should have PVC or teflon insulation and should be approximately two feet long. The loose ends of the leads should not be stripped or terminated with lugs.
(13) Ensure that the three springs are in place on the Flasher Housing. Pass the four leads from the flasher through the central opening at the bottom of the Flasher Housing.
(14) Pull the leads through the opening in the beacon base as the Lampchanger Plate is lowered into place over the Flasher Housing.
(15) Screw the Lampchanger Plate to the Flasher Housing. Do not overtighten, as the three capscrews will be adjusted during the focusing procedure.
(16) Cut any excessive length from the four leads coming from the flasher and out the Terminal Plate opening. Strip ¼" of insulation from the ends of the four leads.
(17) Secure the two yellow leads to the output terminals for the daylight control.
(18) Secure the black lead to the Lamp (+) output terminal.
(19) Secure the white lead to the Lamp (-) output terminal.
(20) Apply a small amount of petroleum jelly to the O-ring on the Terminal Plate. Place the Terminal Plate over the opening and secure with the four capscrews.

Data Sheet 6-E(17). (cont'd).

6.E.

Wiring and Hardware Configurations—External Control. Figure 6-43 illustrates the basic wiring schematic for the externally-controlled VRB-25 rotating beacon. (Note: the Lampchanger Plate is not shown.) Selection of standard or high-wattage versions of the six-place lampchanger depends on the lamp that will be used. The euro-style terminals on the beacon Terminal Plate will allow for wire size up to 10AWG.

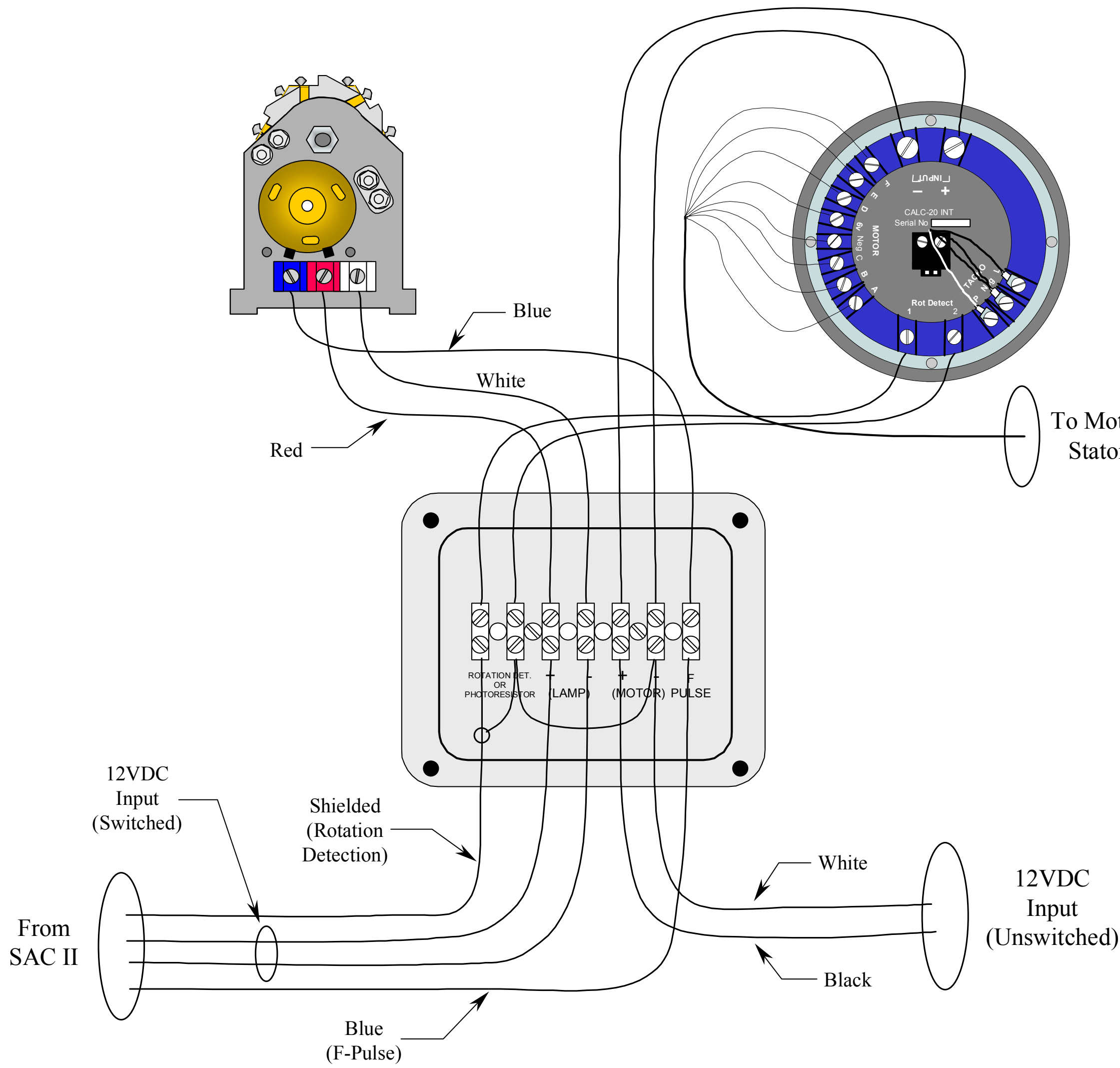


Figure 6-43. Wiring Diagram for VRB-25 Rotating Beacon (External Control).

(1) Unscrew the four capscrews that secure the Terminal Plate to the beacon base and remove the Terminal Plate from the beacon.
(2) Insert the power cable through the cable gland. Strip ¼ inch of insulation from the ends of each lead and secure to the Lamp (+) and (-) terminals. Secure the cable gland.

Data Sheet 6-E(17). (cont'd).

(3) Insert four leads (one black, one white, one blue, and one shielded 18AWG) through a second cable gland. The black and white leads must provide unswitched 12VDC power for the drive motor. Black is positive, and white is negative. The blue lead is for the "F" pulse from the SAC II. The shielded 18AWG lead will transmit the rotation detection signal to the SAC II.
(4) Strip ¼" of insulation from the ends of the black and white leads and connect to the Motor (+) and (-) inputs on the terminal strip, respectively.
(5) Strip ¼" of insulation from the end of the blue lead and connect to the F-pulse input terminal.
(6) Wire the shield from the 18AWG lead to one of the two Rotation Detection inputs on the terminal strip, and jumper to the Motor (-) input.
(7) Strip ¼" of insulation from the end of the 18AWG lead, using care not to make a connection with the shield, and connect the lead to the remaining input of the Rotation Detection terminals.
(8) Release the eight thumb latches located on the lower ring of the Glazing Assembly by rotating 180°. Carefully remove the assembly from the beacon.
(9) Looking down into the beacon, remove the capscrews securing the Lampchanger Plate to the Flasher Housing, and remove the plate. (Leave the three springs that surround the capscrews in place.)
(10) Orient a CG-6P/CG-6PHW lampchanger on the Lampchanger Plate so that the terminal strip faces TOWARDS the opening on the plate.
(11) Secure the lampchanger to the Lampchanger Plate with four 10-32 stainless steel bolts and nuts.
(12) Wire the lampchanger with one each black and white lamp power leads and one 14AWG blue F-pulse lead. The leads should have PVC or teflon insulation and should be approximately two feet long. The loose ends of the leads should not be stripped or terminated with lugs.
(13) Ensure that the three springs are in place on the Flasher Housing. Pass the three leads from the flasher through the central opening at the bottom of the Flasher Housing.
(14) Pull the leads through the opening in the beacon base as the Lampchanger Plate is lowered into place over the Flasher Housing.
(15) Screw the Lampchanger Plate to the Flasher Housing. Do not overtighten, as the three capscrews will be adjusted during the focusing procedure.
(16) Cut any excessive length from the three leads coming from the lampchanger and out the Terminal Plate opening. Strip ¼" of insulation from the ends of the three leads.
(17) Secure the black lead to the Lamp (+) output terminal.
(18) Secure the white lead to the Lamp (-) output terminal.
(19) Secure the blue lead to the F-pulse output terminal.
(20) Apply a small amount of petroleum jelly to the O-ring on the Terminal Plate. Place the Terminal Plate over the opening and secure with the four capscrews.

Data Sheet 6-E(17). (cont'd).

Installation. The VRB-25 rotating beacon has three mounting holes, equally spaced on a 7-7/8" bolt circle. The beacon comes with three stainless steel ½" diameter x 4" long threaded rods, each with two Nyloc (self-locking) nuts, two plain hex nuts, and four flat washers for mounting the beacon.

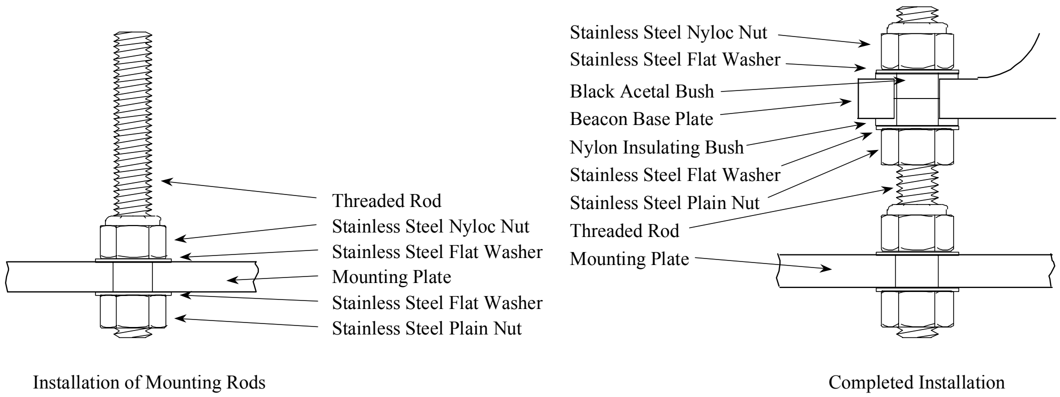


Figure 6-44. Mounting the VRB-25 Rotating Beacon

(1) Install the three threaded rods equally spaced around a 7-7/8" bolt circle on the platform, as illustrated in figure 6-44. A plain nut and flat washer go on the underside of the platform, with a flat washer and Nyloc nut against the top of the platform.

(2) Add the leveling nut (plain) and a flat washer to each rod.

(3) Position the beacon and lower onto the three threaded rods. Do not remove or lose the black bushings in the mounting holes.

(4) Place a flat washer and Nyloc nut onto each threaded rod. Do not tighten completely. Use Army-Navy Grommets (McMaster Carr part number 9307K27, (908) 329-3200) between the flat washers surrounding the beacon base if the mounting platform is subject to noticeable vibration.

(5) Use the bubble level on the bottom of the lens cage to level the beacon. Slowly rotate the lens cage. The bubble should stay centered within the circle through an entire rotation.

(6) Adjust the leveling nuts up or down, until the bubble remains centered through an entire rotation. Note, the threads on the mounting rods are coarse, relative to the sensitivity of the bubble level. Final adjustments will require incremental turns of the leveling nuts.

(7) Gently tighten the top nuts on the mounting rods. Rotate the lens cage and recheck the levelness of the beacon.

(8) If the bubble does not remain centered, loosen the top nuts and adjust the leveling nuts to keep as much of the bubble as possible within the inner circle throughout an entire rotation of the lens cage. Tighten the top nuts.

Data Sheet 6-E(17). (cont'd).

Focusing. The VRB-25 rotating beacon comes with a precision focus fixture for use in focusing the optic. If this focus fixture is lost, a standard 12-volt focus fixture may be used in its place. Each fresnel lens has a small circular alignment hole at its center, to serve as sighting marks. Follow the procedures outlined below to focus the optic:

(1) Remove the glazing assembly by releasing the eight thumb latches, located on the lower ring of the glazing assembly, and carefully lift the assembly from the beacon.
(2) Install the focus fixture in the first lampchanger position.
(3) Sight through the center of three adjacent lens panels and check to see if the tip of the focus fixture is centered in the sight picture (a white sheet of paper held behind the rear lens is helpful in obtaining a clear sight picture, if the background is dark). Do not rotate the lens cage to look through the adjacent lens panels; keep the beacon stationary and move around it.
(4) Using a $^{5}/_{32}$" Allen wrench, adjust the three spring-loaded capscrews that hold the lampchanger plate to the flasher housing until the tip of the focus fixture is correctly positioned.

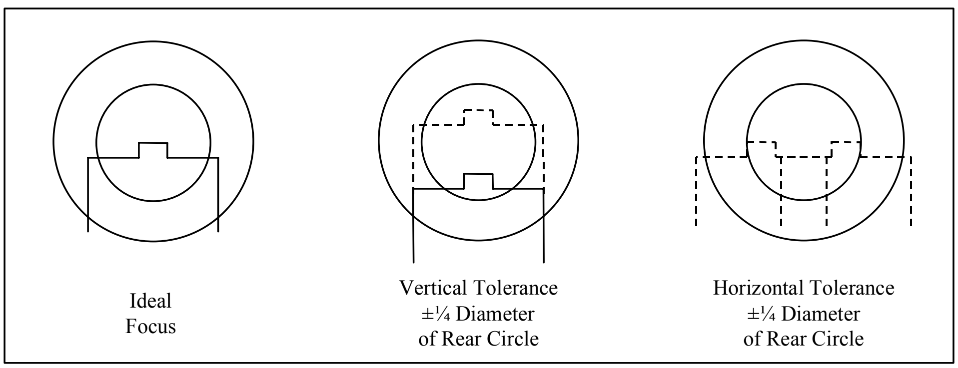


Figure 6-45. Sight Picture to Focus VRB-25 Rotating Beacon

(5) Remove the focus fixture, and install lamps in all six positions of the lampchanger.
(6) Rotate the lampchanger to the first position.
(7) Lower the glazing assembly into position, taking care not to scratch the internal surface on the upper lens retaining ring. (The O-ring installed on the upper lens retaining ring is intended to provide some protection for the glazing assembly. It may be rubber-cemented into place, or removed, if desired.)
(8) Secure the eight thumb latches that hold the glazing assembly into place.

Performance Characteristics. The performance characteristics of the VRB-25 rotating beacon are outlined in Table 6-11 (clear lens panels), Table 6-12 (red lens panels) and Table 6-13 (green lens panels). Beacons displaying alternating characteristics shall be rated based on the lowest value obtained.

Data Sheet 6-E(17). (cont'd).

Table 6-11
Nominal Range and Apparent Flash Length for a VRB-25 Rotating Beacon
—White—

Lamp	Rotation Rate (rpm)									
	2/3	**1**	**1-1/3**	**1-1/2**	**1-2/3**	**2**	**2-1/2**	**3**	**4**	**5**
12 V, **0.77 A**										
Nominal Range (nm)	15	15	14	14	13	13	13	13	12	11
Flash Length (sec)	.13	.11	.09	.08	.07	.07	.06	.05	.04	.04
12 V, **1.15 A**										
Nominal Range (nm)	16	15	15	14	14	14	13	13	13	12
Flash Length (sec)	.12	.09	.08	.07	.07	.06	.05	.05	.04	.03
12 V, **2.03 A**										
Nominal Range (nm)	17	17	16	16	16	15	15	15	14	14
Flash Length (sec)	.15	.12	.10	.09	.08	.07	.06	.05	.04	.04
12 V, **3.05 A**										
Nominal Range (nm)	18	17	17	17	16	16	16	15	15	14
Flash Length (sec)	.15	.12	.10	.09	.08	.07	.06	.06	.05	.04
12 V, **1.0 A, CC-8**										
Nominal Range (nm)	17	16	16	16	15	15	15	14	14	13
Flash Length (sec)	.14	.11	.09	.08	.08	.07	.06	.05	.04	.03
12 V, **1.9 A, CC-8**										
Nominal Range (nm)	18	18	17	17	17	16	16	16	15	15
Flash Length (sec)	.14	.11	.09	.08	.08	.07	.06	.05	.04	.03
12 V, **3.0 A, CC-8**										
Nominal Range (nm)	19	19	18	18	18	17	17	16	16	15
Flash Length (sec)	.16	.12	.10	.09	.09	.08	.07	.06	.04	.04
12 V, **35 W, T-H**										
Nominal Range (nm)	20	19	19	18	18	18	17	17	16	16
Flash Length (sec)	.14	.11	.09	.08	.08	.07	.06	.05	.04	.04
12 V, **50 W, T-H**										
Nominal Range (nm)	20	20	19	19	19	19	18	18	17	17
Flash Length (sec)	.14	.11	.09	.08	.08	.07	.06	.05	.04	.04
12 V, **75 W, T-H**										
Nominal Range (nm)	21	21	20	20	20	19	19	18	18	17
Flash Length (sec)	.16	.12	.10	.09	.08	.07	.06	.06	.04	.04
12 V, **100 W, T-H**										
Nominal Range (nm)	22	21	21	20	20	20	19	19	19	18
Flash Length (sec)	.16	.12	.11	.10	.09	.08	.07	.06	.05	.05
12 V, **110W, TH**										
Nominal Range (nm)	22	21	21	21	20	20	20	19	19	18
Flash Length (sec)	.14	.11	.09	.08	.08	.07	.06	.05	.04	.03

Data Sheet 6-E(17). (cont'd).

Table 6-12
Nominal Range and Apparent Flash Length for a VRB-25 Rotating Beacon
—Red—

Lamp	2/3	1	1-1/3	1-1/2	1-2/3	2	2-1/2	3	4	5
	Rotation Rate (rpm)									
12 V, **0.77 A**										
Nominal Range (nm)	13	12	12	11	11	11	11	10	10	9
Flash Length (sec)	.13	.11	.09	.08	.07	.07	.06	.05	.04	.04
12 V, **1.15 A**										
Nominal Range (nm)	14	13	13	12	12	12	11	11	10	10
Flash Length (sec)	.12	.09	.08	.07	.07	.06	.05	.05	.04	.03
12 V, **2.03 A**										
Nominal Range (nm)	15	14	14	14	14	13	13	13	12	12
Flash Length (sec)	.15	.12	.10	.09	.08	.07	.06	.05	.04	.04
12 V, **3.05 A**										
Nominal Range (nm)	16	15	15	14	14	14	14	13	13	12
Flash Length (sec)	.15	.12	.10	.09	.08	.07	.06	.06	.05	.04
12 V, **1.0 A, CC-8**										
Nominal Range (nm)	15	14	14	13	13	13	13	12	12	11
Flash Length (sec)	.14	.11	.09	.08	.08	.07	.06	.05	.04	.03
12 V, **1.9 A, CC-8**										
Nominal Range (nm)	16	15	15	15	15	14	14	13	13	13
Flash Length (sec)	.14	.11	.09	.08	.08	.07	.06	.05	.04	.03
12 V, **3.0 A, CC-8**										
Nominal Range (nm)	17	16	16	16	15	15	15	14	14	13
Flash Length (sec)	.16	.12	.10	.09	.09	.08	.07	.06	.04	.04
12 V, **35 W, T-H**										
Nominal Range (nm)	18	17	16	16	16	16	15	15	14	14
Flash Length (sec)	.14	.11	.09	.08	.08	.07	.06	.05	.04	.04
12 V, **50 W, T-H**										
Nominal Range (nm)	18	18	17	17	17	16	16	16	15	14
Flash Length (sec)	.14	.11	.09	.08	.08	.07	.06	.05	.04	.04
12 V, **75 W, T-H**										
Nominal Range (nm)	19	18	18	18	17	17	17	16	16	15
Flash Length (sec)	.16	.12	.10	.09	.08	.07	.06	.06	.04	.04
12 V, **100 W, T-H**										
Nominal Range (nm)	19	19	18	18	18	18	17	17	16	16
Flash Length (sec)	.16	.12	.11	.10	.09	.08	.07	.06	.05	.05
12 V, **110 W, T-H**										
Nominal Range (nm)	20	19	19	18	18	18	17	17	16	16
Flash Length (sec)	.15	.11	.09	.08	.07	.06	.06	.05	.04	.03

Data Sheet 6-E(17). (cont'd).

Table 6-13
Nominal Range and Apparent Flash Length for a VRB-25 Rotating Beacon
—Green—

Lamp	Rotation Rate (rpm)									
	2/3	**1**	**1-1/3**	**1-1/2**	**1-2/3**	**2**	**2-1/2**	**3**	**4**	**5**
12 V, **0.77 A**										
Nominal Range (nm)	12	12	11	11	11	10	10	10	9	9
Flash Length (sec)	.13	.11	.09	.08	.07	.07	.06	.05	.04	.04
12 V, **1.15 A**										
Nominal Range (nm)	13	12	12	12	12	11	11	11	10	10
Flash Length (sec)	.12	.09	.08	.07	.07	.06	.05	.05	.04	.04
12 V, **2.03 A**										
Nominal Range (nm)	15	14	14	13	13	13	12	12	11	11
Flash Length (sec)	.15	.12	.10	.09	.08	.07	.06	.05	.04	.04
12 V, **3.05 A**										
Nominal Range (nm)	15	15	14	14	14	13	13	13	12	12
Flash Length (sec)	.15	.12	.10	.09	.08	.07	.06	.06	.05	.04
12 V, **1.0 A, CC-8**										
Nominal Range (nm)	14	14	13	13	13	12	12	12	11	11
Flash Length (sec)	.14	.11	.09	.08	.08	.07	.06	.05	.04	.03
12 V, **1.9 A, CC-8**										
Nominal Range (nm)	16	15	14	14	14	14	13	13	12	12
Flash Length (sec)	.14	.11	.09	.08	.08	.07	.06	.05	.04	.03
12 V, **3.0 A, CC-8**										
Nominal Range (nm)	16	16	15	15	15	15	14	14	13	13
Flash Length (sec)	.16	.12	.10	.09	.09	.08	.07	.06	.04	.04
12 V, **35 W, T-H**										
Nominal Range (nm)	17	16	16	16	15	15	15	14	14	13
Flash Length (sec)	.14	.11	.09	.08	.08	.07	.06	.05	.04	.04
12 V, **50 W, T-H**										
Nominal Range (nm)	18	17	17	16	16	16	15	15	14	14
Flash Length (sec)	.14	.11	.09	.08	.08	.07	.06	.05	.04	.04
12 V, **75 W, T-H**										
Nominal Range (nm)	18	18	17	17	17	16	16	16	15	15
Flash Length (sec)	.16	.12	.10	.09	.08	.07	.06	.06	.04	.04
12 V, **100 W, T-H**										
Nominal Range (nm)	19	18	18	18	17	17	17	16	16	15
Flash Length (sec)	.16	.12	.11	.10	.09	.08	.07	.06	.05	.05
12 V, **110 W, T-H**										
Nominal Range (nm)	19	19	18	18	18	17	17	17	16	15
Flash Length (sec)	.16	.12	.10	.09	.09	.08	.06	.06	.05	.04

Data Sheet 6-E(17). (cont'd).

6.E.

Dimensions. The VRB-25 rotating beacon has a height of 26" (661mm), without the bird spike. The overall height of the beacon will depend on how high it is mounted on the three mounting rods, and whether or not the bird spike is employed. The weight of the beacon is approximately 48 lbs (22kg).

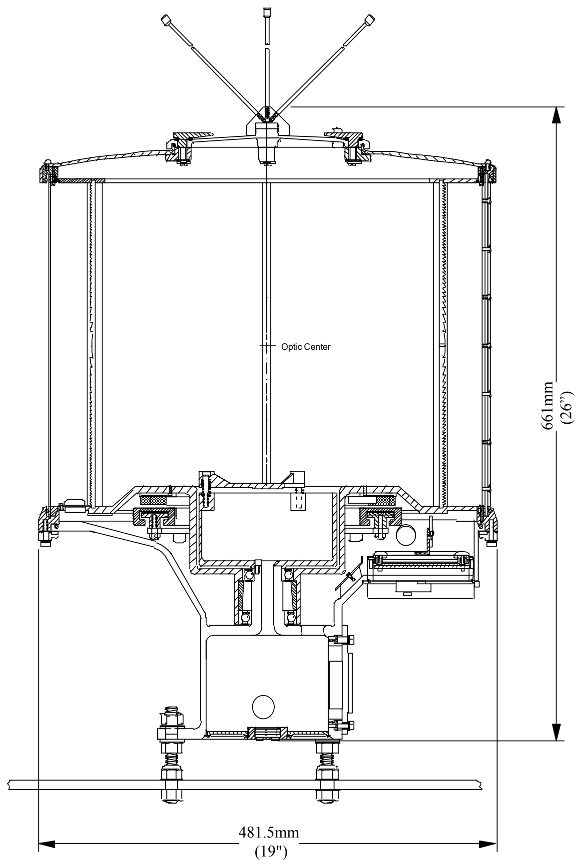


Figure 6-46. Overall Dimensions of the VRB-25 Rotating Beacon.

Additional Data. Additional information on the VRB-25 rotating beacon may be found in the *Installation and Instruction Manual* that comes with the beacon, and the Short Range Servicing Guide. The VRB-25 rotating beacon is stocked at Engineering Logistics Center, Baltimore, in Project 98A. Also stocked is a Spare Parts Kit, containing a motor controller, motor stator, tacho transducer, turntable bearing sets, two input-protection capacitors, and auto reset device and lightning protection device (consult COMDT (G-SEC-2A) for specifics). Additional spares in the ELC Supply Fund include lens panels (clear, red, and green, and blanking panels), glazing assemblies, and a bearing puller/installer. Requests for VRB-25 rotating beacons and spare parts kits should be addressed to Commandant (G-SEC-2A). The beacons are delivered with six clear lens panels, and set with a rotation rate of 1 rpm. Mouser Electronics, (800) 346-6873 has an acceptable input protection capacitor; 50V, 2200 microfarad, high-temperature, radial, electrolytic capacitor, part number 140-HTRL50V2200.

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Data Sheet 6-E(17). (cont'd).

FA-251-AC Rotating Beacon

Function. The FA-251-AC rotating beacon is powered by 120VAC, and is outfitted with the CG-4P lampchanger and 120-volt, 150 watt lamps. This beacon is no longer manufactured, but existing beacons may be retained in service. The FA-251-AC rotating beacon uses the same base as the 250mm marine signal lantern. It must be mounted on structures not subject to noticeable vibration, and will provide a maximum nominal range for a white or colored light of 17 or 15 nautical miles, respectively.

Features.

- Requires precise focusing and leveling.
- Replaceable clear, red or green lenses and blanking panels.
- Replaceable clear, red or green lens cover.
- Forced air cooling.
- Pre-set rotation rate.
- Cannot be used with color sectors in the lens cover.
- Daylight control supplied by manufacturer.

Related Equipment. The FA-251-AC must be equipped with the CG-4P lampchanger and 120-volt, 150 watt tungsten-halogen lamps. The manufacturer-supplied daylight control may be replaced by a Type K daylight control, when necessary.

Data Sheet 6-E(18). FA-251-AC Rotating Beacon.

6.E.

Wiring. **USE EXTREME CAUTION WHEN INSTALLING, TESTING, OR SERVICING UNITS WITH 120VAC POWER**. The power cable used for the FA-251-AC rotating beacon shall be 12/3 SO cable. Note, the FA-251-AC uses the same base as the 250mm marine signal lantern, with a modified lens ring/support arm assembly to hold the lampchanger mounting ring. The lampchanger mounting bracket and mounting lens are illustrated in Data Sheet 6-E(15).

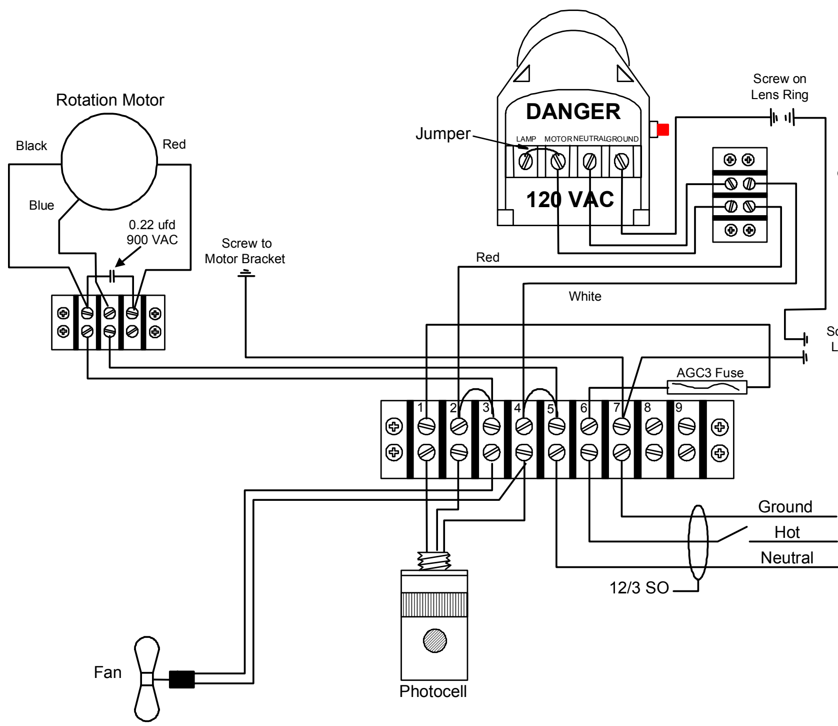


Figure 6-47. Wiring Schematic for the FA-251-AC Rotating Beacon.

(1) Open the lantern, and insert the power cable through the cable gland. **INSURE THAT POWER IS SECURED.** Terminate the leads with spring spade lugs sized for a #8 stud. Wire the cable to the terminal block in the base of the lantern, and tighten the cable gland.

(2) Insure that a red and white lead run from the terminal block in the base of the lantern, to a second terminal block on the lens ring. A green wire should also be in place, running from a screw on the lantern base to a screw on the lens ring.

(3) Remove the pipe plug from the ¾" NPT threaded hole. Install a ¾" to ½" reducer pipe bushing in the threaded hole. Insert the photoresistor leads for a Type K daylight control through the hole. Screw the daylight control into the threaded hole and tighten gently with a wrench.

(4) Wire the leads from the daylight control, if used, to the terminal block in the base of the lantern.

(5) Wire a CG-4P lampchanger with green, red and white wires. Leave the jumper between the red and black terminals on the CG-4P in place.

Data Sheet 6-E(18). (cont'd).

(6) Mount the CG-4P to the mounting bracket. The wires on the CG-4P must go inside the mounting ring.
(7) Install a 120-volt, 150 watt focus fixture in the first position of the lampchanger, and secure the lampchanger assembly to the support arms of the beacon (the modified support arms do not require spacers, as are used in the 250mm lantern)..
(8) Wire the red and white leads from the CG-4P to the terminal block on the lens ring. Wire the green lead from the CG-4P to the grounding screw on the lens ring.
(9) Dress any loose wires.
(10) Close the beacon, while insuring that the three wires running from the base to the lens ring are not pinched by the lens ring. Secure the lantern with the three captive screws.

Installation. The FA-251-AC rotating beacon shall not be installed on platforms subject to noticeable vibration. Vibration isolators, as described in Data Sheet 6-E(17), may be used to eliminate slight vibrations that might affect smooth rotation of the beacon. The FA-251-AC rotating beacon uses the same base as the 250mm lantern, with four 2" x 7/16" mounting slots, equally spaced around a 7-7/8" bolt circle (see figure 6-32). Use only three of the four mounting slots to install the lantern. The basic procedures for installing the FA-251-AC are the same as those outlined for installation of a 155mm buoy lantern on a structure (see Data Sheet 6-E(13)). The FA-251-AC must be mounted high enough over the mounting plate to allow free circulation of air being exhausted by the internal cooling fan.

Focusing. The FA-251-AC rotating beacon requires precise focusing. The focus should be checked upon initial installation, when the lampchanger or lampchanger bracket are replaced, and whenever the optic is relamped. Each of the lens panels has a clear sighting mark, providing up to three separate sight pictures. Procedures for focusing the FA-251-AC are as follows:

(1) Secure the lampchanger assembly to the support arms.
(2) Tighten the focus adjustment screws on the mounting bracket by turning the “D” rings **COUNTER-CLOCKWISE** until the mounting bracket is tight against the mounting ring.
(3) Turn each of the focus adjustment screws **CLOCKWISE** six (6) complete revolutions. Close the lantern, but do not secure the lens assembly to the base.
(4) Without rotating the lens cage, check the sight picture for each of the three pairs of lenses by looking through the clear sighting marks in the center of the lenses. Turn the focus adjustment screws until the tip of the focus fixture is centered in all three sight pictures.
(5) Remove the lampchanger assembly by loosening the three wing nuts on the support arms. **DO NOT TURN THE “D” RINGS ON THE MOUNTING BRACKET**.
(6) Remove the focus fixture, and install 120-volt 150 watt lamps in the lampchanger.
(7) Reinstall the lampchanger assembly in the lantern, and secure the lens assembly to the base.

Data Sheet 6-E(18). (cont’d).

6.E.

Performance Characteristics. The performance characteristics for the FA-251-AC rotating beacon, for the most commonly used rotation rates, are outlined in Table 6-14.

Table 6-14
Performance Characteristics of the FA-251-AC Rotating Beacon
(Outfitted with 120-volt, 150 watt tungsten-halogen lamps)

Color of Light Signal (Lens or Lens Cover)	Rotation Rate (rpm)					
	1	2	3	4	5	10
	Nominal Range (nm)					
White	17	17	16	15	15	14
Red	15	14	13	13	12	11
Green	15	14	13	13	12	11
Flash Length (sec)	.20	.12	.09	.07	.06	.03

Vertical Divergence	(Degrees)	Horizontal Divergence	(Degrees)
50% of Peak Intensity	±8.2	50% of Peak Intensity	±1.0
10% of Peak Intensity	±10	10% of Peak Intensity	±2.0

Dimensions.

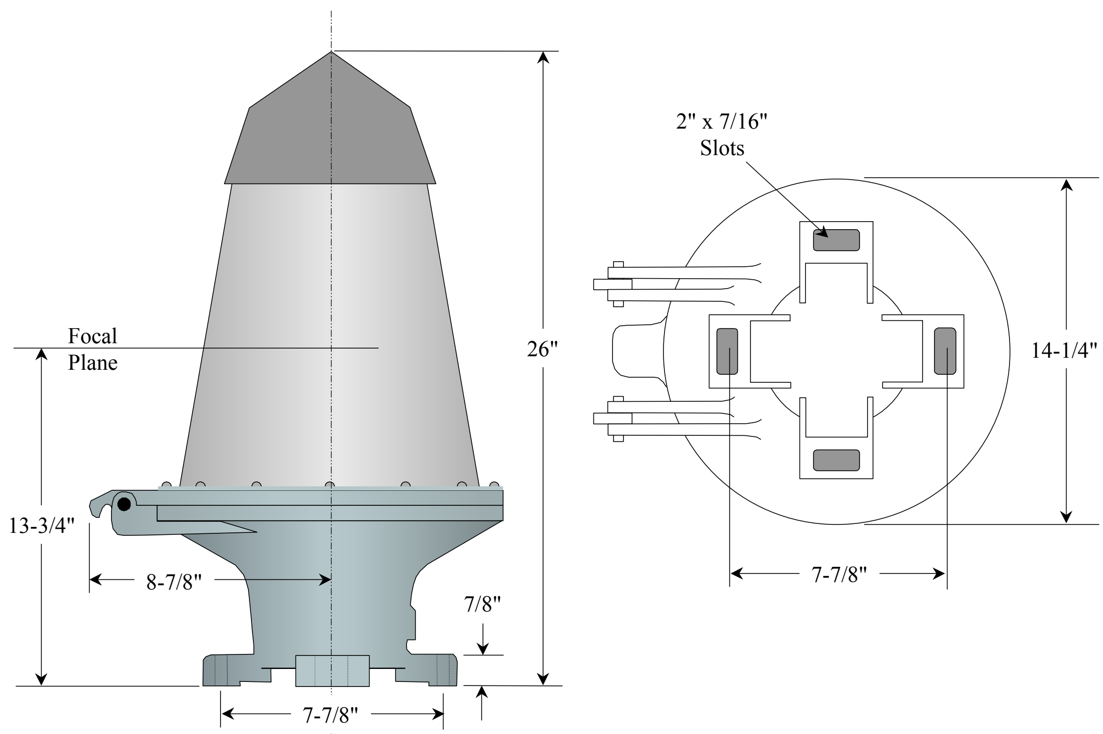


Figure 6-48. FA-251-AC Rotating Beacon Dimensions.

Data Sheet 6-E(18). (cont'd).

6.E.

Additional Data. The FA-251-AC rotating beacon was manufactured by Automatic Power, Inc., (713) 228-5208. It has been replaced by the FA-252-AC rotating beacon. The only common parts are the base and lens panels. Other components are no longer available. Replacement motors are available directly from Hurst Manufacturing Division, Emerson Electric Company. Insure to retain the square-bar drive shaft that connects the drive shaft of the motor to the lens cage of the beacon when replacing the motor. The air filter may be replaced using a FRAM CA140PL or equivalent air filter. Plastic bearings are available from Commandant (G-SEC-2A). (Bearing lubricant blocks may be removed when plastic bearings are installed.)

Data Sheet 6-E(18). (cont'd).

DCB24 & DCB224 Rotating Beacons

Function. The DCB-24 and DCB-224 are the Coast Guard's standard 120-volt rotating beacons for landfall lights. These optics are used for lights that require effective intensities in excess of 40,000 candela, where 120VAC power is available. The DCB-24 and DCB-224 rotating beacons emit one and two pencil beams, respectively, which sweep the horizon.

Safety Warnings. USE EXTREME CAUTION WHEN INSTALLING, TESTING, OR SERVICING UNITS WITH 120VAC POWER. THE DCB24/224 BEACONS DO NOT HAVE A SLIP CLUTCH IN THE DRIVE MECHANISM. BE CAREFUL NOT BE GET CAUGHT BETWEEN ANY ROTATING AND NON-ROTATING PARTS. COMPONENTS IN THE DCB24/224 BEACONS BECOME VERY HOT. ALLOW THE BEACON TO COOL FOR 15 MINUTES BEFORE OPENING. WEAR A FACE SHIELD OR GOGGLES WHEN HANDLING LAMPS, AND GLOVES AND LONG SLEEVES TO PROTECT AGAINST HEAT.

Features.

- Aluminum base and housing.
- Available with one drum or two drums.
- Adjustable beam separation permits a variety of group or alternating characteristics.
- Maintains rated rotation rate in wind speeds of up to 100 knots.
- Rotation detection signal provided by a magnetic reed switch.
- Lampchanger provides lampchanger position signal (mode detection) for monitoring.
- Separate lamp and motor circuits.
- Uses Class C, 1/4 hp motor, which draws 4.9 A at 120VAC, to drive rotation.
- Variety of pre-set speed reducers available.
- Replaceable clear, green, or red cover glasses.

Data Sheet 6-E(19). DCB24 & DCB224 Rotating Beacons.

6.E.

Related Equipment. The DCB-24 and DCB-224 shall rotate 24 hours per day. The optics may be daylight contolled using an AC Flash Controller equipped with a Fixed flasher and a Type L daylight control. An Audio-Visual Controller is used to monitor the DCB24/224 beacons and to interface the main light with an emergency light. The controllers are described in Chapter 9.

The DCB24/224 beacons come equipped with the CG-2P lampchanger. A 120-volt, 1000 watt tungsten-halogen lamp with a CC-8 filament and mogul bi-post base is used in the CG-2P lampchanger.

Wiring. Wiring schematics for the DCB24/224 rotating beacons are provided in the appropriate *24-Inch Rotating Beacon Instruction Book*. The beacons are furnished with all necessary internal wiring. Unmonitored beacons can be wired through a service disconnect or, if daylight controlled, an AC Flash Controller. Monitored beacons are wired to an Audio-Visual Controller.

Wiring used with the DCB24/224 rotating beacons shall be 12 AWG for the lamp and motor circuits, and 14 AWG for the rotation detector and lampchanger position (if monitored). Wires shall have insulated spring spade lugs. A terminal block is provided for all necessary incoming leads in the base of the beacon. Terminations are as illustrated in figure 6-49.

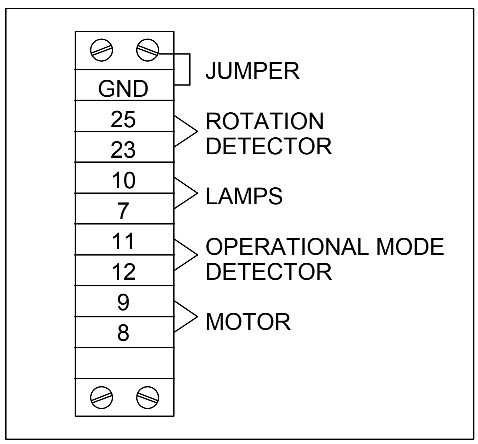


Figure 6-49. Terminal Block for Incoming Leads—DCB24 and DCB224 Rotating Beacons.

Installation. The net weight of the DCB24 and DCB224 rotating beacons is 330 lbs and 470 lbs, respectively. Weight handling equipment is required to facilitate installation. Disassembly of the drums from the base may be necessary to maneuver the beacon into place. DCB24/224 beacons must be mounted on a stable platform. These beacons are top-heavy and may tip over until permanently installed. Use extreme caution when maneuvering a beacon into place. The DCB24/224 beacons are secured to the lantern deck (platform) using the ¾ inch cap screws provided with the beacon. Use the hardware (bolts, flat washers and lock washers) that secured the beacon to the shipping crate. An accurately machined leveling pad is provided on the top of the beacon base. Step by step procedures are outlined below:

Data Sheet 6-E(19). (cont'd).

(1) Drill three holes, equally spaced on a 21½ inch bolt circle, through the deck. The holes should be large enough for ¾ inch cap screws, provided with the beacons.
(2) Position the beacon so that the mounting holes are aligned with the beacon legs.
(3) Secure the beacon to the deck with the three cap screws, flat washers and split washers that were used to secure the beacon during shipment.
(4) Loosen the top nut on each of the three legs.
(5) Place a torpedo level on the machined leveling pad located on top of the beacon base. The torpedo level should be aligned with one of the three legs, and perpendicular to a line between the remaining two legs.
(6) Adjust the lower nut at the top of the leg that the level is aligned with until the beacon is level in that direction.
(7) Rotate the level 90 degrees, and adjust the lower nut at the top of the other two legs until the beacon is level.
(8) Check the level in each direction, and repeat steps (6) and (7), as necessary.
(9) Tighten the three top lock nuts and recheck to ensure the leveling adjustments have not been disturbed.

Focusing. The optical system of a DCB24/224 rotating beacon is accurately focused by the manufacturer. Adjustments are not necessary unless the optical system has been changed, such as when a mirror or lampchanger is replaced. Focusing adjustments are NOT required when a lamp is replaced. Follow the procedures in the AC Servicing Guide, in the event that focusing is required.

Performance Characteristics. The effective intensity, apparent flash length, and nominal range of the DCB24 and DCB224 rotating beacons, for standard rotation rates are outlined in table 6-15.

Table 6-15
Performance Characteristics of the DCB24 and DCB224 Rotating Beacons

Speed (rpm)	Apparent Flash Length (sec)	Effective Intensity w/ Clear cover (cd)*	Nominal Range (nm)			
			At Peak Intensity		15% Peak Intensity	
			White	Colored	White	Colored
1	0.63	1,180,000	26	21	21	17
2	0.32	860,000	25	21	20	16
3	0.21	690,000	24	20	19	15
4	0.16	580,000	24	20	19	15
5	0.13	510,000	23	19	19	15
6	0.11	450,000	23	19	18	14
10	0.06	310,000	22	19	17	14
12	0.05	270,000	22	18	17	13

*The transmittance of the red and green covers relative to the clear cover are both 0.20.

Data Sheet 6-E(19). (cont'd).

Table 6-16 provides the rhythms of the white and colored pencil beams emitted from a DCB24 or DCB224 drum equipped with the 120-volt, 1000 watt, tungsten-halogen lamp:

Table 6-16
Beam Characteristics of the DCB24 and DCB224 Rotating Beacons

Lamp current rating (A)	8.3
Power (W)	1000
Vertical divergence (degrees)	
50% of peak intensity	+2.3
15% of peak intensity	+2.9
Horizontal divergence (degrees)	
50% of peak intensity	+0.7
15% of peak intensity	+1.1

Dimensions. The DCB24 and DCB224 rotating beacons are illustrated in figure 6-50 and figure 6-51, respectively.

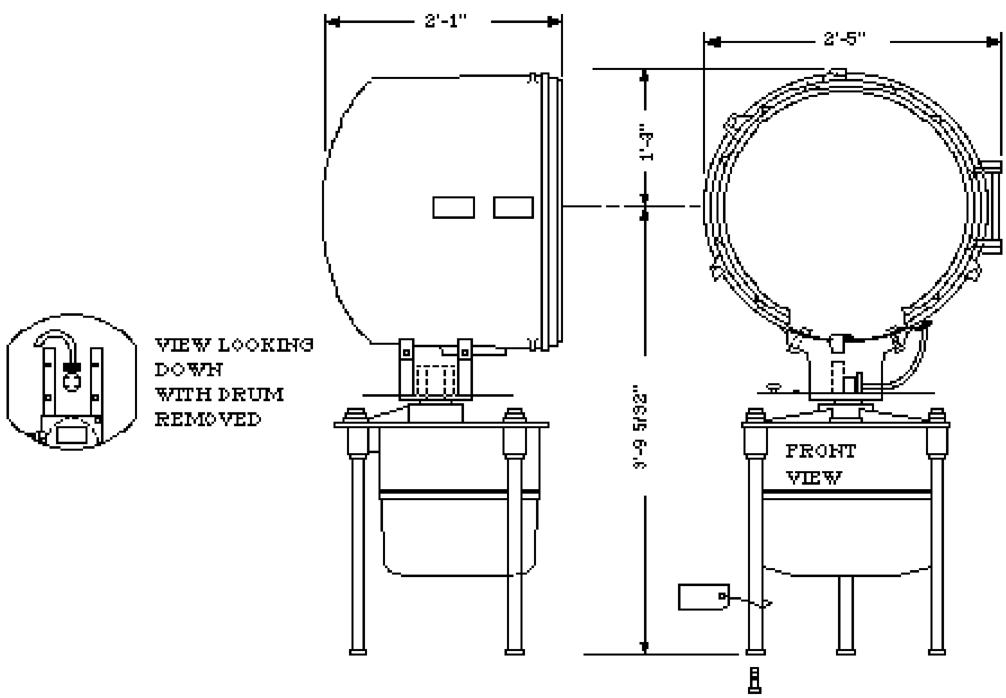


Figure 6-50. Dimensions of the DCB24 Rotating Beacon.

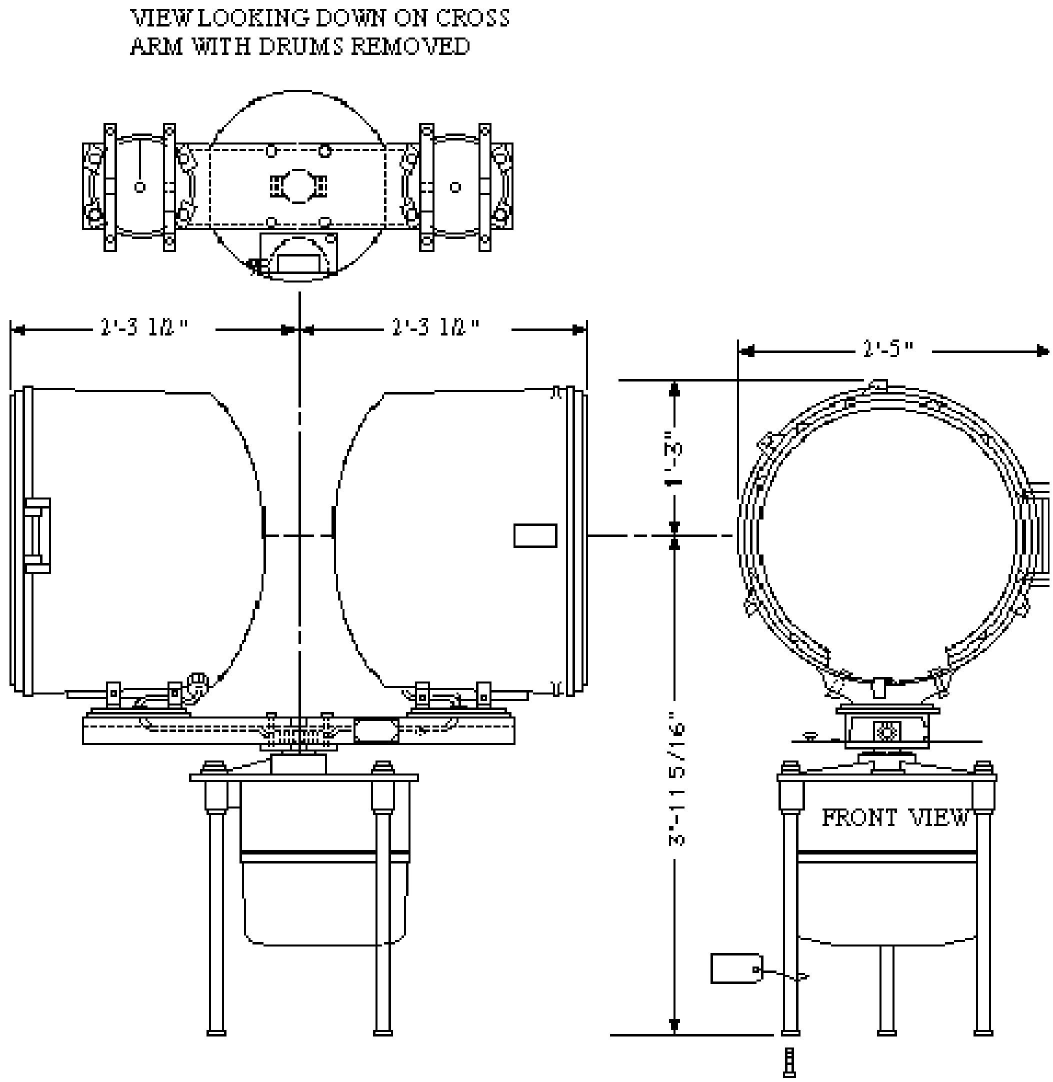
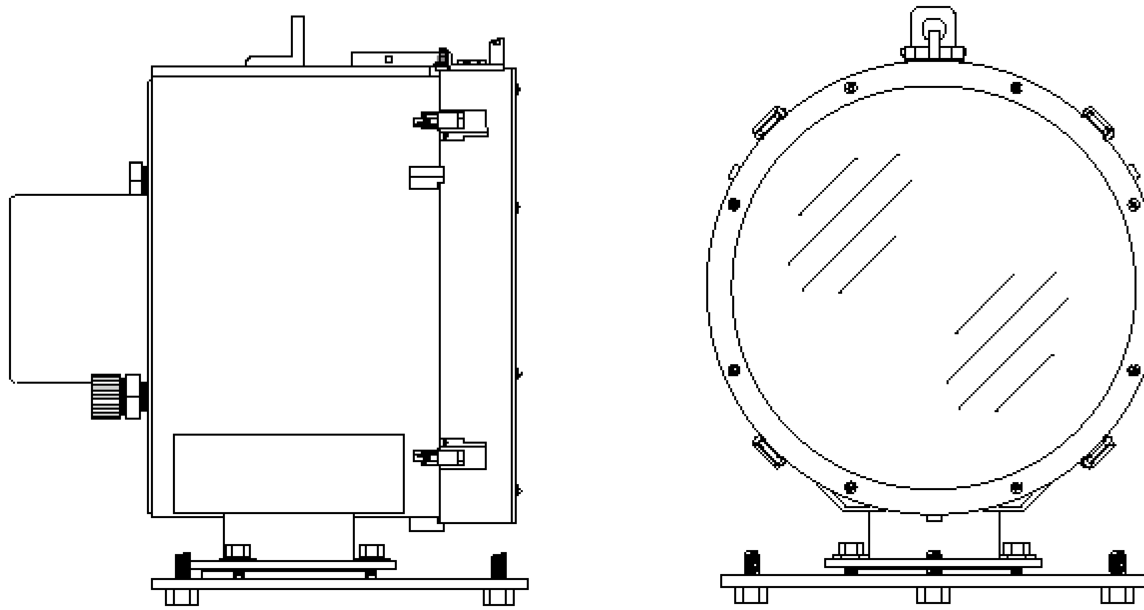


Figure 6-51. Dimensions of the DCB224 Rotating Beacon.

Additional Data. The DCB24 rotating beacon and DCB224 rotating beacon are stocked at Engineering Logistics Center, Baltimore, in Project 98A. Requests for DCB24 and DCB224 beacons should be addressed to Commandant (G-SEC-2A). The manufacturer of the beacons is The Carlisle and Finch Co., (513) 681-6080. The Crouse-Hinds version of the 24-inch beacons are not authorized for new installations, and should be replaced when no longer serviceable.

Data Sheet 6-E(19). (cont'd).

RL14 Range Lantern



Function. The RL14 range lantern emits a high intensity pencil beam for use as a range light, and may be outfitted with either standard 12-volt or 120-volt lighting hardware. The RL14 range lantern must be installed on a stable platform.

Features.

- Anodized aluminum housing.
- Watertight seals.
- Requires precision leveling.
- Prefocused for standard 12-volt and 120-volt lamps.
- Replaceable clear, green, and red transparent cover glasses.
  (Note—cover glasses have no lensing power. Lanterns outfitted with a cover glass have beamwidths (full width at half maximum) of about 1.0 degrees.)
- Several spread lenses available (clear, green, and red).

Related Equipment. The RL14 range lantern may be outfitted with standard 12-volt or 120-volt AtoN hardware. For 12-volt applications the lantern is outfitted with a CG-6P/CG-6PHW lampchanger and CG-181/CG-481 flasher. For 120-volt applications, the lantern may be outfitted with a CG-4P lampchanger (with or without a Type K daylight control) for fixed-on signals, or with a CG-4P lampchanger and FLAC-300 flasher, for flashing signals. A Type L daylight control is used for 12-volt applications, and when an FLAC-300 is installed. Tables 6-17 through 6-19, which provide the performance characteristics of the lantern, also provide the permissible combinations of lantern, lamp, and spread lenses. Fields showing “N/A” mean that the equipment combination is not authorized.

Data Sheet 6-E(20). RL14 Range Lantern.

6.E.

Wiring & Component Installation—12-Volt. The power cable used for 12-volt operation shall be 12/2 SO cable. (Note: a Low-Voltage Drop Kit (see Chapter 9) may be used to allow for installation of heavier gauge cable between the battery room and on the lantern deck in an effort to reduce voltage drop over the power run.) The procedures listed below are for stand-alone range lanterns that are daylight controlled. Eliminating the daylight control will result in a 24-hour per day range light signal. Day/night ranges are controlled by a Range Switch Box-DC (see Chapter 9). The wiring schematic for a 12VDC day/night range system is illustrated in Ocean Engineering Drawing 140503.

(1) Open the range lantern door, and lock the door in the open position.
(2) Insert the power cable through the cable gland. Terminate the leads with spring spade lugs sized for a #8 stud. Do not tighten the cable gland.
(3) Remove the pipe plug from the ¾" NPT threaded hole. Insert the photoresistor leads for a Type L daylight control through the hole. Screw the daylight control into the threaded hole and tighten gently with a wrench.
(4) Locate the "DC Installation Kit," which came with the RL14 range lantern. Using the color-coded wires from the kit, wire a six-place lampchanger and flasher together, as discussed in Data Sheet 6-E(6). The lampchanger bracket should be oriented so that the label "CG6P" is up (see figure 6-52). Use a CG-6PHW lampchanger and CG-481 flasher if the lantern is to be outfitted with tungsten-halogen lamps rated above 35 watts.
(5) Rotate the spacer blocks located at the back of the lantern drum so that the lampchanger bracket will rest over the spaces marked for the CG-6P. Gently tighten the mounting screw for each spacer block.
(6) Wire the power cable and Type L daylight control to the flasher.
(7) Mount the lampchanger/flasher assembly on the spacer blocks using the screws, flat washers, and lock washers provided.
(8) Tighten the cable gland, and dress any loose wires.
(9) Close the range lantern door and carefully latch all the latches.

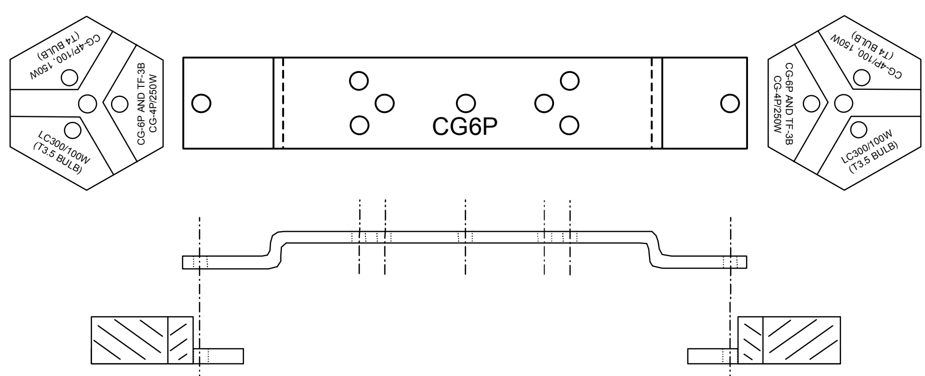


Figure 6-52. Lampchanger Bracket and Spacer Orientation for 12-volt Installation.

Data Sheet 6-E(20). (cont'd).

6.E.

<u>Wiring & Component Installation—120-Volt</u>. The power cable used for 120-volt operation shall be 12/3 SO cable. The procedures listed below are for stand-alone range lanterns that are daylight controlled. Eliminating the daylight control will result in a 24-hour per day range light signal. Day/night ranges are controlled by a Range Switch Box-AC (see Chapter 9). The wiring schematic for a 120VAC day/night range is illustrated in Ocean Engineering Drawing 130503.

a. Fixed-on:

(1) Open the range lantern door, and lock the door in the open position.
(2) Insert the power cable through the cable gland. **INSURE THAT POWER IS SECURED.** Terminate the leads with spring spade lugs sized for a #8 stud. Wire the cable to the terminal block on the back wall of the lantern, and tighten the cable gland.
(3) Remove the pipe plug from the ¾" NPT threaded hole. Install a ¾" to ½" reducer pipe bushing in the threaded hole. Insert the leads, and screw a Type K daylight control into the threaded hole. Tighten gently with a wrench.
(4) Using the "AC Installation Kit" that came with the lantern, attach the color-coded wires to a CG-4P lampchanger. If a daylight control is used, remove the jumper between the red and black terminals of the CG-4P.
(5) Mount the CG-4P to the lampchanger bracket, with the bracket oriented so that the label "CG4P" is up.
(6) Wire the Type K daylight control to the CG-4P.
(7) Rotate the spacer blocks located at the back of the lantern drum so the lampchanger bracket will rest over the spaces marked for the CG-4P AND for the selected lamp (150 or 250 watt), as illustrated in figure 6-53 and figure 6-54.
(8) Mount the lampchanger assembly on the spacer blocks using the screws, flat washers, and lock washers provided.
(9) Wire the AC installation kit leads that are installed on the CG-4P to the terminal block.
(10) Dress any loose wires.
(11) Close the range lantern door and carefully latch all the latches.
(12) Turn 120-volt power on.

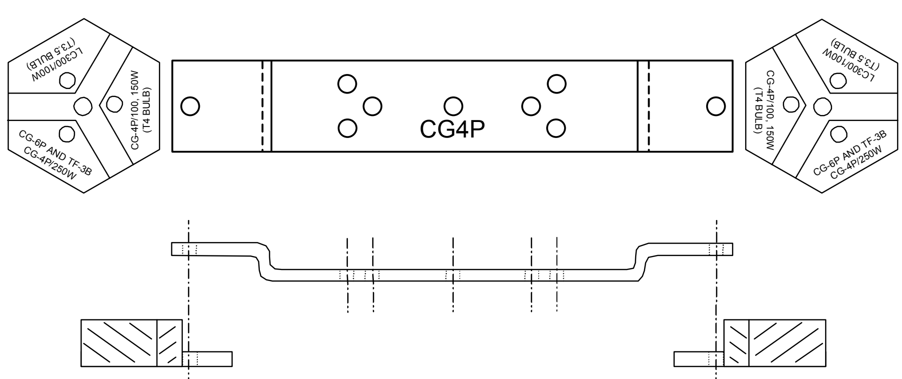


Figure 6-53. Lampchanger Bracket and Spacer Orientation for 120-volt, 150 watt Installation.

Data Sheet 6-E(20). (cont'd).

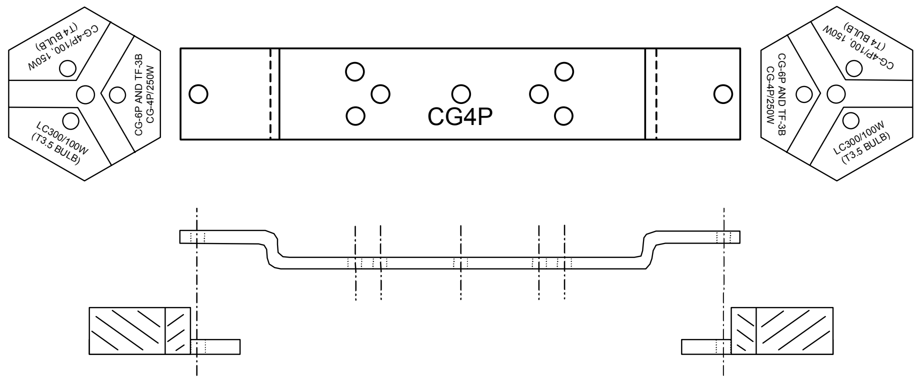


Figure 6-54. Lampchanger Bracket and Spacer Orientation for 120-volt, 250 watt Installation.

b. Flashing:

(1) Open the range lantern door, and lock the door in the open position.
(2) Insert the power cable through the cable gland. **INSURE THAT POWER IS SECURED.** Terminate the leads with spring spade lugs sized for a #8 stud. Wire the cable to the terminal block on the back wall of the lantern, and tighten the cable gland.
(3) Remove the pipe plug from the ¾" NPT threaded hole. Insert the photoresistor leads for a Type L daylight control through the hole. Screw the daylight control into the threaded hole and tighten gently with a wrench.
(4) Using the "AC Installation Kit" that came with the lantern, attach the color-coded wires to a CG-4P lampchanger.
(5) Mount the CG-4P to the lampchanger bracket, with the bracket oriented so that the label "CG4P" is up.
(6) Mount a FLAC-300 flasher to the lampchanger bracket.
(7) Wire the FLAC-300 and CG-4P lampchanger together, using the wires that come with the FLAC-300, as illustrated in Data Sheet 6-E(8).
(8) Wire the Type L daylight control to the FLAC-300 flasher.
(9) Rotate the spacer blocks located at the back of the lantern drum so the lampchanger bracket will rest over the spaces marked for the CG-4P AND for the selected lamp (150 or 250 watt), as illustrated in figure 6-53 and figure 6-54.
(11) Mount the lampchanger/flasher assembly on the spacer blocks using the screws, flat washers, and lock washers provided.
(12) Wire the AC installation kit leads that are installed on the CG-4P to the terminal block.
(13) Dress any loose wires.
(14) Close the range lantern door and carefully latch all the latches.
(15) Turn 120-volt power on.

Data Sheet 6-E(20). (cont'd).

6.E.

Mounting, Leveling & Alignment. The RL14 range lantern requires precision leveling and alignment. The mounting pattern for the RL14 has three equally spaced 7/16" holes on a 14¾" (375mm) bolt circle. Use 3/8" bolts, which are passed through the leveling bolts, to secure the range lantern to the lantern stand. Prior to tightening the mounting bolts, level the range lantern by adjusting the leveling bolts (see figure 6-55). After the range lantern is leveled and the mounting bolts tightened, loosen the three clamp bolts (see figure 6-56) and rotate the drum to the desired direction. Figure 6-57 illustrates the sight picture for alignment. Final alignment may require placing an observation vessel on the centerline at the far end of the channel, especially for long channels or when a spread lens is not used. Slowly sweep the beam back and forth across the channel until the observer indicates that the intensity of the signal light is at its peak. Tighten the clamp bolts, and recheck the leveling. Relevel the range lantern, if necessary.

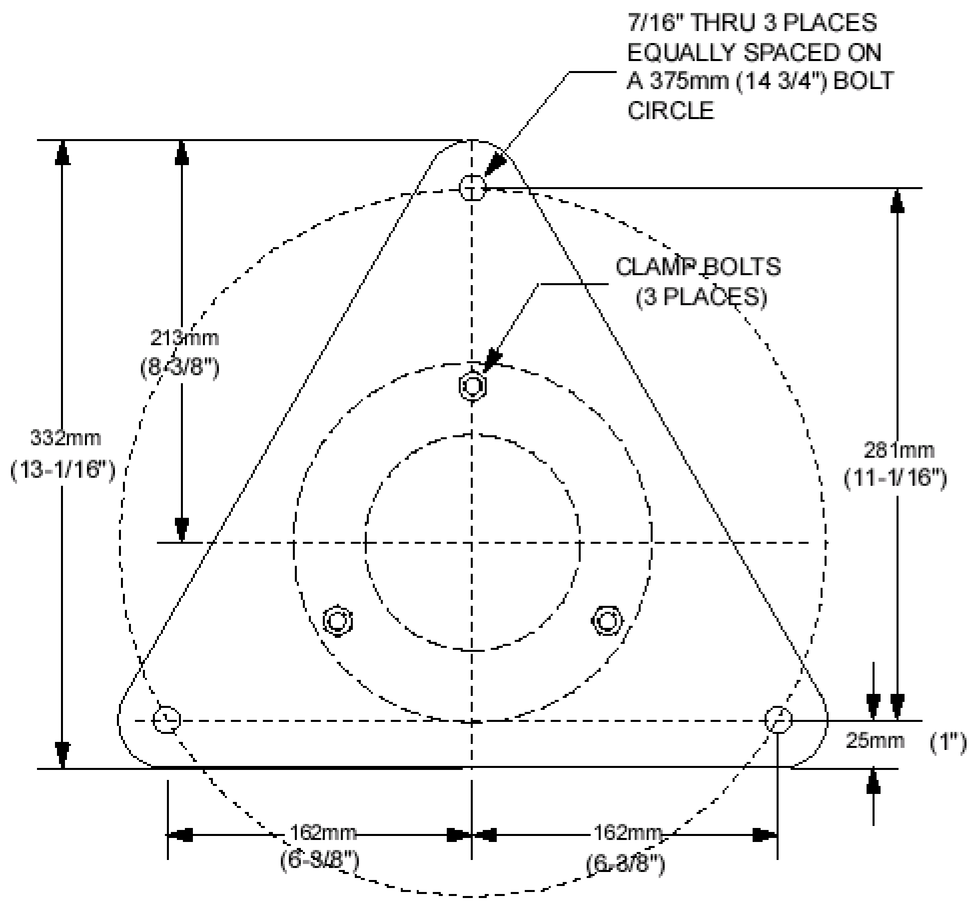


Figure 6-55. RL14 Range Lantern Mounting Pattern.

Data Sheet 6-E(20). (cont'd).

6.E.

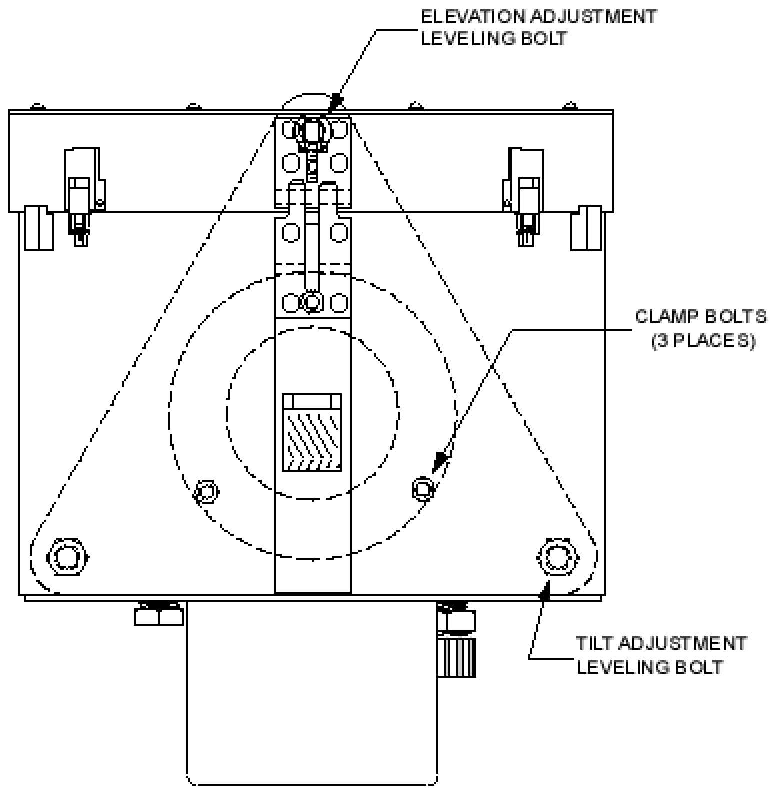
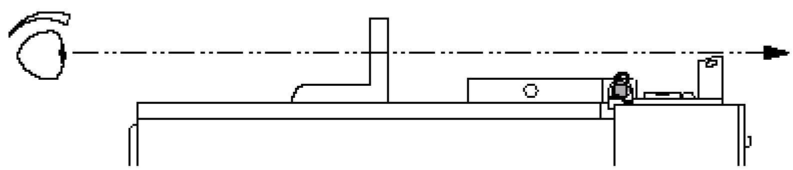
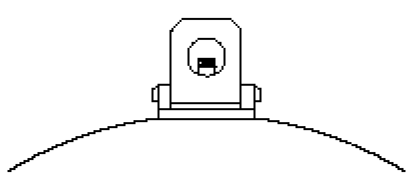


Figure 6-56. Leveling & Alignment Adjustments for RL14 Range Lantern



(Side View)



(Rear View)

Figure 6-57. Sight Picture for Alignment of the RL14 Range Lantern

<u>Performance Characteristics</u>. The performance characteristics of the RL14 range lantern, for all lamps and available spread lenses, are provided in Table 6-17 (white), Table 6-18 (red) and Table 6-19 (green)

Data Sheet 6-E(20). (cont'd).

6.E.

Table 6-17.
RL14 Effective Intensities—White.

RHYTHM:		Q	ISO 2 / FL 2.5(1)	OCC 4 / ISO 6	F
CONTACT CLOSURE TIME:		0.3	1.0	3.0	FIXED
LENS:	LAMP:				
FLAT	12VDC 0.25A	N/A	N/A	N/A	N/A
	0.55A	N/A	N/A	N/A	N/A
	0.77A	N/A	N/A	N/A	N/A
	1.15A	N/A	N/A	N/A	N/A
	2.03A	N/A	N/A	N/A	N/A
	3.05A	N/A	N/A	N/A	N/A
	12VDC 1.0A	83,000	140,000	160,000	180,000
	1.9A	100,000	200,000	240,000	260,000
	3.0A	N/A	320,000	380,000	410,000
	12VDC 35W	N/A	530,000	630,000	690,000
	50W	N/A	600,000	760,000	820,000
	75W	N/A	740,000	960,000	1,000,000
	100W	N/A	920,000	1,200,000	1,300,000
	110W	N/A	980,000	1,300,000	1,500,000
	120VAC150W	340,000	610,000	700,000	760,000
	250W	290,000	590,000	700,000	750,000
3 DEG	12VDC0.25A	7,300	11,000	13,000	14,000
	0.55A	18,000	29,000	34,000	36,000
	0.77A	24,000	40,000	45,000	49,000
	1.15A	35,000	62,000	72,000	77,000
	2.03A	54,000	110,000	130,000	140,000
	3.05A	N/A	150,000	180,000	200,000
	12VDC 1.0A	29,000	50,000	58,000	62,000
	1.9A	43,000	83,000	99,000	110,000
	3.0A	N/A	140,000	170,000	180,000
	12VDC 35W	N/A	190,000	230,000	250,000
	50W	N/A	240,000	310,000	330,000
	75W	N/A	330,000	430,000	470,000
	100W	N/A	440,000	590,000	640,000
	110W	N/A	450,000	610,000	670,000
	120VAC150W	190,000	330,000	390,000	420,000
	250W	180,000	360,000	430,000	470,000

Data Sheet 6-E(20). (cont'd).

6.E.

Table 6-17.
RL14 Effective Intensities—White (cont'd).

RHYTHM:			Q	ISO 2 / FL 2.5(1)	OCC 4 / ISO 6	F
CONTACT CLOSURE TIME:			0.3	1.0	3.0	FIXED
LENS:	LAMP:					
8 DEG	12VDC	0.25A	2,800	4,300	4,800	5,200
		0.55A	8,400	14,000	16,000	17,000
		0.77A	10,000	17,000	19,000	21,000
		1.15A	16,000	28,000	33,000	35,000
		2.03A	26,000	51,000	61,000	66,000
		3.05A	N/A	79,000	94,000	100,000
	12VDC	1.0A	13,000	23,000	26,000	28,000
		1.9A	20,000	39,000	46,000	50,000
		3.0A	N/A	65,000	78,000	85,000
	12VDC	35W	N/A	90,000	110,000	120,000
		50W	N/A	120,000	150,000	160,000
		75W	N/A	160,000	200,000	220,000
		100W	N/A	220,000	290,000	320,000
		110W	N/A	220,000	300,000	330,000
	120VAC	150W	100,000	180,000	210,000	230,000
		250W	110,000	220,000	260,000	280,000
11 DEG	12VDC	0.25A	2,000	3,000	3,400	3,700
		0.55A	5,900	9,600	11,000	12,000
		0.77A	7,600	12,000	14,000	15,000
		1.15A	12,000	21,000	24,000	26,000
		2.03A	19,000	37,000	45,000	48,000
		3.05A	N/A	56,000	67,000	73,000
	12VDC	1.0A	11,000	20,000	23,000	24,000
		1.9A	16,000	31,000	37,000	40,000
		3.0A	N/A	53,000	63,000	69,000
	12VDC	35W	N/A	73,000	87,000	95,000
		50W	N/A	94,000	120,000	130,000
		75W	N/A	130,000	160,000	180,000
		100W	N/A	170,000	230,000	250,000
		110W	N/A	180,000	240,000	260,000
	120VAC	150W	78,000	140,000	160,000	170,000
		250W	84,000	170,000	200,000	220,000

Data Sheet 6-E(20). (cont’d).

Table 6-17.
RL14 Effective Intensities—White (cont'd).

RHYTHM:			Q	ISO 2 / FL 2.5(1)	OCC 4 / ISO 6	F
CONTACT CLOSURE TIME:			0.3	1.0	3.0	FIXED
LENS:	LAMP:					
20 DEG	12VDC	0.25A	1,100	1,600	1,900	2,000
		0.55A	3,300	5,300	6,100	6,600
		0.77A	4,200	6,700	7,700	8,300
		1.15A	6,400	11,000	13,000	14,000
		2.03A	10,000	20,000	24,000	26,000
		3.05A	N/A	30,000	36,000	40,000
	12VDC	1.0A	5,100	8,800	10,000	11,000
		1.9A	7,600	15,000	18,000	19,000
		3.0A	N/A	25,000	30,000	33,000
	12VDC	35W	N/A	33,000	39,000	43,000
		50W	N/A	44,000	55,000	60,000
		75W	N/A	61,000	79,000	86,000
		100W	N/A	84,000	110,000	120,000
		110W	N/A	84,000	110,000	130,000
	120VAC	150W	41,000	73,000	85,000	91,000
		250W	44,000	89,000	110,000	110,000
28 DEG	12VDC	0.25A	860	1,300	1,500	1,600
		0.55A	2,600	4,100	4,700	5,100
		0.77A	3,100	4,900	5,700	6,100
		1.15A	4,900	8,600	10,000	11,000
		2.03A	7,600	15,000	18,000	19,000
		3.05A	N/A	23,000	28,000	30,000
	12VDC	1.0A	3,900	6,600	7,600	8,200
		1.9A	5,900	11,000	14,000	15,000
		3.0A	N/A	20,000	23,000	25,000
	12VDC	35W	N/A	22,000	26,000	28,000
		50W	N/A	33,000	42,000	46,000
		75W	N/A	47,000	61,000	66,000
		100W	N/A	63,000	83,000	91,000
		110W	N/A	64,000	87,000	96,000
	120VAC	150W	32,000	57,000	66,000	71,000
		250W	35,000	71,000	85,000	91,000

Data Sheet 6-E(20). (cont’d).

Table 6-18.
RL14 Effective Intensities—Green.

RHYTHM:			Q	ISO 2 / FL 2.5(1)	OCC 4 / ISO 6	F
CONTACT CLOSURE TIME:			0.3	1.0	3.0	FIXED
LENS:	LAMP:					
FLAT	12VDC	0.25A	N/A	N/A	N/A	N/A
		0.55A	N/A	N/A	N/A	N/A
		0.77A	N/A	N/A	N/A	N/A
		1.15A	N/A	N/A	N/A	N/A
		2.03A	N/A	N/A	N/A	N/A
		3.05A	N/A	N/A	N/A	N/A
	12VDC	1.0A	19,000	33,000	38,000	41,000
		1.9A	24,000	47,000	56,000	60,000
		3.0A	N/A	73,000	87,000	95,000
	12VDC	35W	N/A	130,000	150,000	160,000
		50W	N/A	140,000	180,000	200,000
		75W	N/A	180,000	230,000	250,000
		100W	N/A	220,000	290,000	320,000
		110W	N/A	230,000	320,000	350,000
	120VAC	150W	85,000	150,000	180,000	190,000
		250W	74,000	150,000	180,000	190,000
3 DEG	12VDC	0.25A	1,700	2,600	2,900	3,100
		0.55A	4,200	6,700	7,700	8,300
		0.77A	5,600	9,100	10,000	11,000
		1.15A	8,000	14,000	16,000	18,000
		2.03A	12,000	25,000	30,000	32,000
		3.05A	N/A	35,000	42,000	46,000
	12VDC	1.0A	6,700	11,000	13,000	14,000
		1.9A	9,800	19,000	23,000	25,000
		3.0A	N/A	32,000	38,000	42,000
	12VDC	35W	N/A	45,000	54,000	59,000
		50W	N/A	58,000	74,000	80,000
		75W	N/A	79,000	100,000	110,000
		100W	N/A	110,000	140,000	150,000
		110W	N/A	110,000	150,000	160,000
	120VAC	150W	47,000	83,000	96,000	100,000
		250W	45,000	91,000	110,000	120,000

Data Sheet 6-E(20). (cont'd).

Table 6-18.
RL14 Effective Intensities—Green (cont'd).

RHYTHM:			Q	ISO 2 / FL 2.5(1)	OCC 4 / ISO 6	F
CONTACT CLOSURE TIME:			0.3	1.0	3.0	FIXED
LENS:	LAMP:					
8 DEG	12VDC	0.25A	650	980	1,100	1,200
		0.55A	1,900	3,100	3,600	3,900
		0.77A	2,400	3,800	4,400	4,700
		1.15A	3,600	6,500	7,500	8,100
		2.03A	5,900	12,000	14,000	15,000
		3.05A	N/A	18,000	22,000	23,000
	12VDC	1.0A	3,100	5,200	6,100	6,500
		1.9A	4,600	8,900	11,000	11,000
		3.0A	N/A	15,000	18,000	20,000
	12VDC	35W	N/A	22,000	26,000	28,000
		50W	N/A	28,000	35,000	38,000
		75W	N/A	37,000	48,000	53,000
		100W	N/A	53,000	70,000	77,000
		110W	N/A	54,000	73,000	80,000
	120VAC	150W	26,000	46,000	53,000	57,000
		250W	27,000	55,000	65,000	70,000
11 DEG	12VDC	0.25A	460	700	790	850
		0.55A	1,400	2,200	2,500	2,700
		0.77A	1,700	2,800	3,300	3,500
		1.15A	2,700	4,700	5,500	5,900
		2.03A	4,300	8,600	10,000	11,000
		3.05A	N/A	13,000	15,000	17,000
	12VDC	1.0A	2,600	4,500	5,200	5,600
		1.9A	3,700	7,100	8,500	9,100
		3.0A	N/A	12,000	15,000	16,000
	12VDC	35W	N/A	18,000	21,000	23,000
		50W	N/A	23,000	28,000	31,000
		75W	N/A	30,000	39,000	43,000
		100W	N/A	42,000	55,000	60,000
		110W	N/A	42,000	58,000	63,000
	120VAC	150W	19,000	35,000	40,000	43,000
		250W	21,000	42,000	50,000	54,000

Data Sheet 6-E(20). (cont’d).

6.E.

Table 6-18.
RL14 Effective Intensities—Green (cont'd).

RHYTHM:			Q	ISO 2 / FL 2.5(1)	OCC 4 / ISO 6	F
CONTACT CLOSURE TIME:			0.3	1.0	3.0	FIXED
LENS:	LAMP:					
20 DEG	12VDC	0.25A	250	380	430	460
		0.55A	760	1,200	1,400	1,500
		0.77A	950	1,500	1,800	1,900
		1.15A	1,500	2,600	3,000	3,300
		2.03A	2,300	4,600	5,500	5,900
		3.05A	N/A	7,000	8,400	9,100
	12VDC	1.0A	1,200	2,000	2,300	2,500
		1.9A	1,700	3,400	4,000	4,300
		3.0A	N/A	5,800	6,900	7,500
	12VDC	35W	N/A	7,900	9,400	10,000
		50W	N/A	10,000	13,000	14,000
		75W	N/A	15,000	19,000	21,000
		100W	N/A	20,000	27,000	29,000
		110W	N/A	20,000	27,000	30,000
	120VAC	150W	10,000	18,000	21,000	23,000
		250W	11,000	22,000	27,000	29,000
28 DEG	12VDC	0.25A	200	300	340	370
		0.55A	590	950	1,100	1,200
		0.77A	700	1,100	1,300	1,400
		1.15A	1,100	2,000	2,300	2,500
		2.03A	1,700	3,500	4,100	4,500
		3.05A	N/A	5,300	6,300	6,900
	12VDC	1.0A	890	1,500	1,800	1,900
		1.9A	1,300	2,600	3,100	3,400
		3.0A	N/A	4,500	5,400	5,900
	12VDC	35W	N/A	5,200	6,300	6,800
		50W	N/A	8,000	10,000	11,000
		75W	N/A	11,000	15,000	16,000
		100W	N/A	15,000	20,000	22,000
		110W	N/A	15,000	21,000	23,000
	120VAC	150W	8,000	14,000	17,000	18,000
		250W	8,900	18,000	21,000	23,000

Data Sheet 6-E(20). (cont’d).

Table 6-19.
RL14 Effective Intensities—Red.

RHYTHM:			Q	ISO 2 / FL 2.5(1)	OCC 4 / ISO 6	F
CONTACT CLOSURE TIME:			0.3	1.0	3.0	FIXED
LENS:	LAMP:					
FLAT	12VDC	0.25A	N/A	N/A	N/A	N/A
		0.55A	N/A	N/A	N/A	N/A
		0.77A	N/A	N/A	N/A	N/A
		1.15A	N/A	N/A	N/A	N/A
		2.03A	N/A	N/A	N/A	N/A
		3.05A	N/A	N/A	N/A	N/A
	12VDC	1.0A	15,000	26,000	30,000	32,000
		1.9A	19,000	37,000	44,000	47,000
		3.0A	N/A	57,000	68,000	74,000
	12VDC	35W	N/A	79,000	95,000	100,000
		50W	N/A	90,000	110,000	120,000
		75W	N/A	110,000	140,000	160,000
		100W	N/A	140,000	180,000	200,000
		110W	N/A	150,000	200,000	220,000
	120VAC	150W	65,000	120,000	130,000	140,000
		250W	56,000	110,000	130,000	140,000
3 DEG	12VDC	0.25A	1,300	2,000	2,300	2,400
		0.55A	3,300	5,300	6,100	6,500
		0.77A	4,400	7,100	8,200	8,800
		1.15A	6,200	11,000	13,000	14,000
		2.03A	9,800	20,000	23,000	25,000
		3.05A	N/A	28,000	33,000	36,000
	12VDC	1.0A	5,200	8,900	10,000	11,000
		1.9A	7,700	15,000	18,000	19,000
		3.0A	N/A	25,000	30,000	33,000
	12VDC	35W	N/A	28,000	34,000	37,000
		50W	N/A	37,000	46,000	50,000
		75W	N/A	50,000	64,000	70,000
		100W	N/A	67,000	89,000	96,000
		110W	N/A	67,000	91,000	100,000
	120VAC	150W	35,000	63,000	73,000	79,000
		250W	35,000	69,000	82,000	89,000

Data Sheet 6-E(20). (cont'd).

6.E.

Table 6-19.
RL14 Effective Intensities—Red (cont'd).

RHYTHM:			Q	ISO 2 / FL 2.5(1)	OCC 4 / ISO 6	F
CONTACT CLOSURE TIME:			0.3	1.0	3.0	FIXED
LENS:	LAMP:					
8 DEG	12VDC	0.25A	510	770	870	940
		0.55A	1,500	2,400	2,800	3,000
		0.77A	1,900	3,000	3,400	3,700
		1.15A	2,900	5,100	5,900	6,300
		2.03A	4,600	9,200	11,000	12,000
		3.05A	N/A	14,000	17,000	18,000
	12VDC	1.0A	2,400	4,100	4,700	5,100
		1.9A	3,600	7,000	8,300	8,900
		3.0A	N/A	12,000	14,000	15,000
	12VDC	35W	N/A	14,000	16,000	18,000
		50W	N/A	17,000	22,000	24,000
		75W	N/A	23,000	30,000	33,000
		100W	N/A	33,000	44,000	48,000
		110W	N/A	33,000	45,000	50,000
	120VAC	150W	20,000	35,000	40,000	44,000
		250W	21,000	41,000	49,000	53,000
11 DEG	12VDC	0.25A	360	550	620	670
		0.55A	1,100	1,700	2,000	2,100
		0.77A	1,400	2,200	2,500	2,700
		1.15A	2,100	3,700	4,300	4,600
		2.03A	3,400	6,700	8,000	8,600
		3.05A	N/A	10,000	12,000	13,000
	12VDC	1.0A	2,100	3,500	4,100	4,400
		1.9A	2,900	5,600	6,600	7,100
		3.0A	N/A	9,500	11,000	12,000
	12VDC	35W	N/A	11,000	13,000	14,000
		50W	N/A	14,000	18,000	19,000
		75W	N/A	19,000	24,000	27,000
		100W	N/A	26,000	35,000	38,000
		110W	N/A	27,000	36,000	40,000
	120VAC	150W	15,000	26,000	31,000	33,000
		250W	16,000	32,000	38,000	41,000

Data Sheet 6-E(20). (cont’d).

Table 6-19.
RL14 Effective Intensities—Red (cont'd).

RHYTHM:			Q	ISO 2 / FL 2.5(1)	OCC 4 / ISO 6	F
CONTACT CLOSURE TIME:			0.3	1.0	3.0	FIXED
LENS:	LAMP:					
20 DEG	12VDC	0.25A	190	300	330	360
		0.55A	590	960	1,100	1,200
		0.77A	750	1,200	1,400	1,500
		1.15A	1,200	2,000	2,400	2,600
		2.03A	1,800	3,600	4,300	4,600
		3.05A	N/A	5,500	6,600	7,100
	12VDC	1.0A	930	1,600	1,800	2,000
		1.9A	1,400	2,700	3,200	3,400
		3.0A	N/A	4,500	5,400	5,900
	12VDC	35W	N/A	4,900	5,900	6,400
		50W	N/A	6,500	8,200	8,900
		75W	N/A	9,200	12,000	13,000
		100W	N/A	13,000	17,000	18,000
		110W	N/A	13,000	17,000	19,000
	120VAC	150W	7,800	14,000	16,000	17,000
		250W	8,400	17,000	20,000	22,000
28 DEG	12VDC	0.25A	160	240	270	290
		0.55A	460	740	850	920
		0.77A	550	890	1,000	1,100
		1.15A	870	1,600	1,800	1,900
		2.03A	1,400	2,700	3,200	3,500
		3.05A	N/A	4,200	5,000	5,400
	12VDC	1.0A	690	1,200	1,400	1,500
		1.9A	1,100	2,100	2,500	2,600
		3.0A	N/A	3,500	4,200	4,600
	12VDC	35W	N/A	3,300	3,900	4,300
		50W	N/A	5,000	6,300	6,800
		75W	N/A	7,100	9,200	9,900
		100W	N/A	9,400	13,000	14,000
		110W	N/A	9,600	13,000	14,000
	120VAC	150W	6,100	11,000	13,000	13,000
		250W	6,700	13,000	16,000	17,000

Data Sheet 6-E(20). (cont’d).

6.E.

Dimensions. The overall dimensions of the RL14 range lantern are illustrated in figure 6-58. The RL14 range lantern weighs approximately 36 lbs. (16 kg).

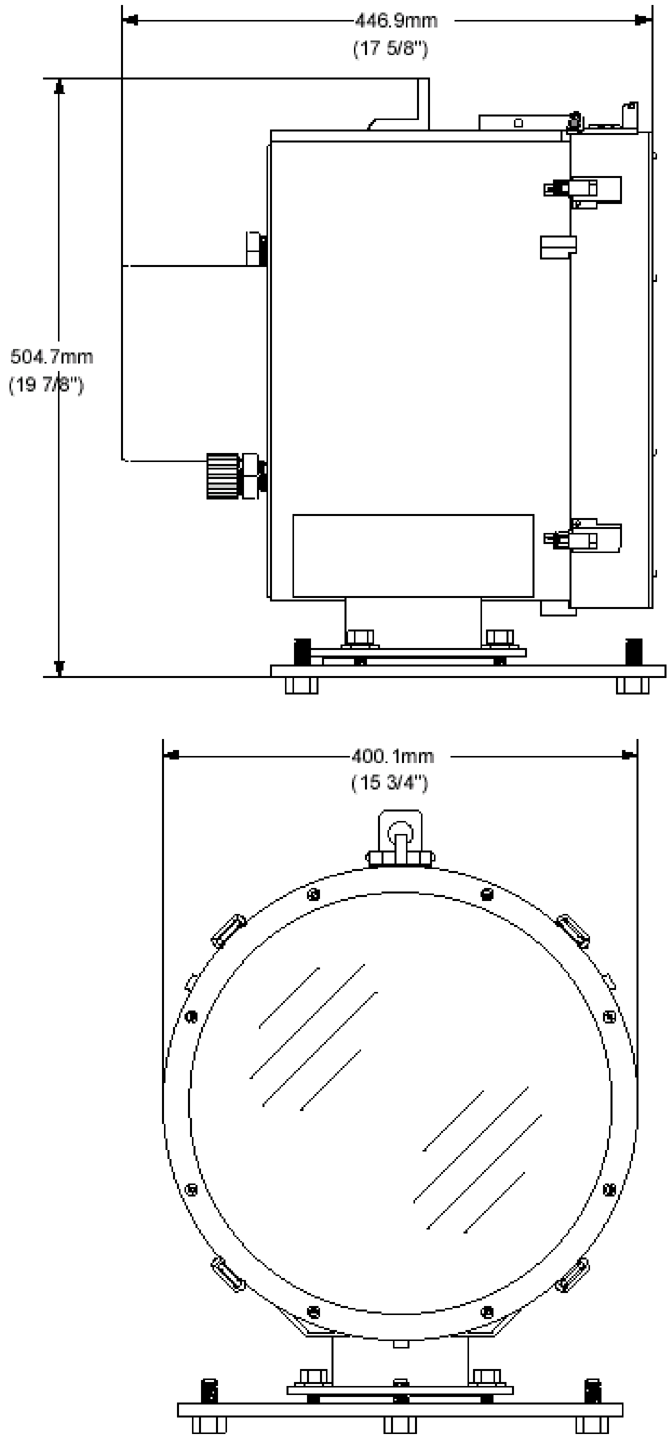


Figure 6-58. Dimensions of the RL14 Range Lantern.

Data Sheet 6-E(20). (cont'd).

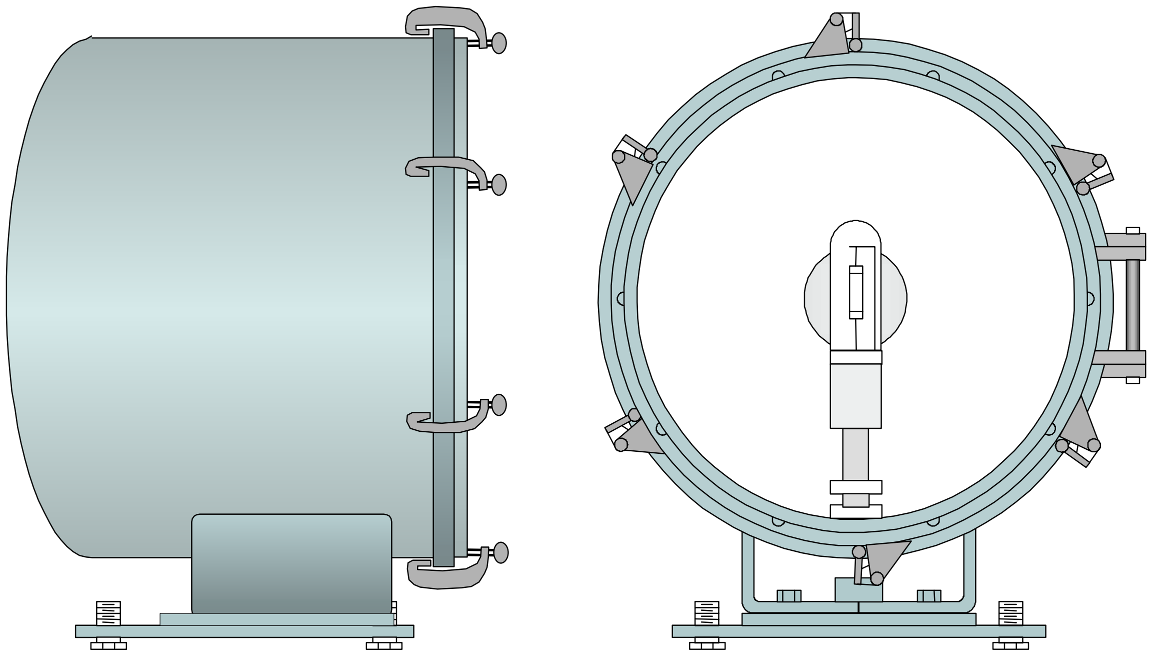
6.E.

Additional Data. There are two versions of the RL14 range lantern that have been installed in the field, one manufactured by Tideland Signal Corp., the second manufactured by The Carlisle and Finch Company. The Tideland Signal Corp. version uses a glass mirror, and was designate the RL355 lantern. It is not authorized for new installations. The Carlisle and Finch Company version has a metal mirror, and machined stops on the bezel assembly and drum, to insure optimum alignment of the optical system whenever the lantern is opened and closed. The RL14 range lantern is stocked at Engineering Logistics Center, Baltimore in Commodity 5 (Supply Fund), with NSN 6210-01-GL3-4426. The lanterns are provided with a clear cover glass. Spread lenses (clear and colored) and colored cover glasses are available as commercial items from Tideland Signal Corp. (713) 681-6101.

Data Sheet 6-E(20). (cont'd).

6.E.

RL24 Range Lantern



Function. The RL24 range lantern emits a high intensity pencil beam for use as a range light. It is outfitted with the 120-volt, 1000 watt tungsten-halogen lamp. The RL24 range lantern must be installed on a stable platform.

Features.

- Aluminum base and housing.
- Lampchanger provided.
- Requires precision focusing and leveling.
- Replaceable clear, green, or red cover glasses.

Related Equipment. The RL24 range lantern is outfitted with the CG-2P lampchanger and 120-volt, 1000 watt tungsten-halogen lamps. The lantern may be daylight controlled with a Type K daylight control, or flashed using the AC Flash Controller with the appropriate CG-181/493 flasher installed (see Chapter 9). Daylight control of a flashed lantern is performed using a Type L daylight control with the AC Flash Controller.

Wiring & Component Installation. The RL24 range lantern is completely wired internally prior to shipment from the manufacturer. A length of four-conductor cable extends out through a watertight stuffing tube. Wiring the RL24 range lantern merely requires connecting the hot line, neutral, lamp failure indicator (if used), and equipment ground to the end of the power cable.

Data Sheet 6-E(21). RL24 Range Lantern

Note, the procedures listed below are for stand-alone range lanterns. Day/night ranges are controlled by a Range Switch Box-AC (see Chapter 9). The wiring schematic for a 120VAC day/night range system is illustrated in Ocean Engineering Drawing 130503.

a. Fixed-on: Stand-alone RL24 range lanterns burning fixed-on, 24 hours per day may be wired through a disconnect to 120VAC power. RL24 range lanterns that have a fixed-on rhythm may be daylight controlled using a Type K daylight control.

b. Flashed: RL24 range lanterns that display a flashing rhythm are controlled using an AC Flash Controller. The AC Flash Controller may be daylight controlled using a Type L daylight control.

Mounting, Leveling & Alignment. The RL24 range lantern requires precision leveling and alignment. The mounting pattern is three equally spaced ½" holes on a 14¾" (375mm) bolt circle. Use ½" bolts, which are passed through the leveling bolts, to secure the range lantern to the lantern stand. Prior to tightening the mounting bolts, level the range lantern by adjusting the leveling bolts. After the range lantern is leveled and the mounting bolts tightened, loosen the four clamp bolts and rotate the drum to the desired direction. Final alignment may require placing an observation vessel on the centerline at the far end of the channel, especially for long channels. Slowly sweep the beam back and forth across the channel until the observer indicates that the intensity of the signal light is at its peak. Tighten the clamp bolts, and recheck the level. Relevel the range lantern, if necessary.

Focusing. The optical system of a DCB24/224 rotating beacon is accurately focused by the manufacturer. Adjustments are not necessary unless the optical system has been changed, such as when a mirror or lampchanger is replaced. Focusing adjustments are NOT required when a lamp is replaced. Follow the procedures in the AC Servicing Guide, in the event that focusing is required.

Performance Characteristics. The performance characteristics of the RL24 range lantern are outlined in Table 6-20.

Table 6-20
Performance Characteristics of the RL24 Range Lantern.

Rhythm:	Iso 2 / Fl 2.5(1)	Occ 4 / Iso 6	F
Contact Closure Time (sec):	1.0	3.0	Fixed
Lens Color:	*Effective Intensity (cd)*		
WHITE	1,700,000	2,300,000	2,500,000
GREEN	350,000	460,000	500,000
RED	380,000	510,000	550,000

Data Sheet 6-E(21). (cont'd).

Dimensions. The basic dimensions of the RL24 range lantern are outlined in figure 6-59. The weight of the lantern (uncrated) is approximately 160 lbs (73kg).

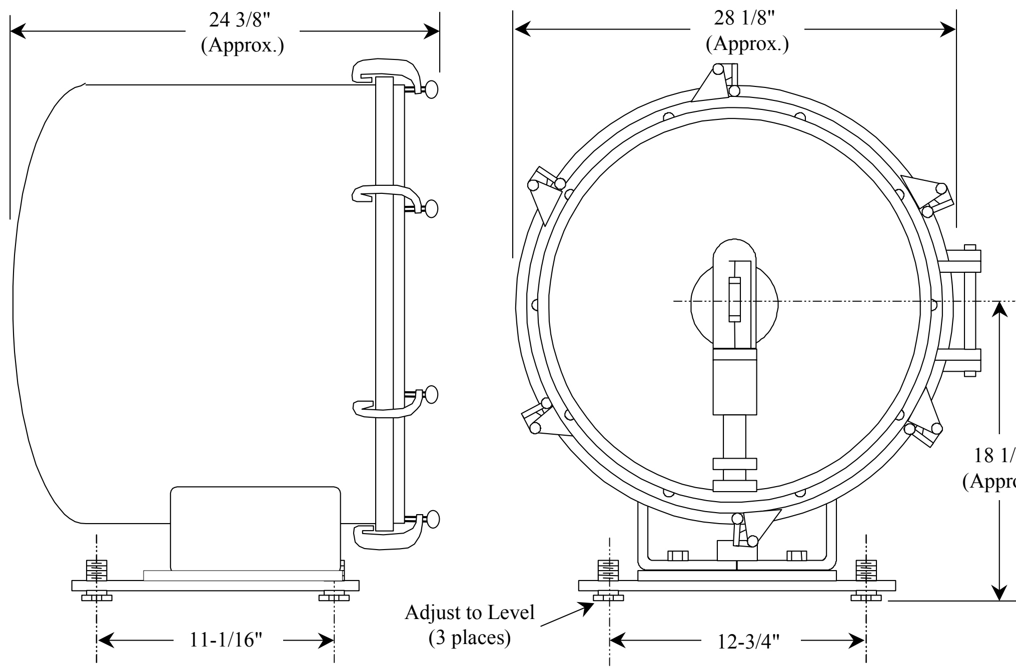


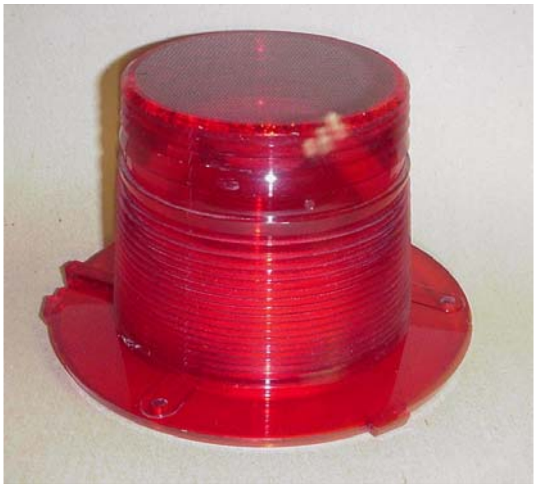
Figure 6-59. RL24 Range Lantern Dimensions.

Additional Data. The RL24 range lantern is stocked at Engineering Logistics Center, Baltimore, in Project 98A Requests for the RL24 range lantern should be addressed to Commandant (G-SEC-2A). The manufacturer of the lanterns is The Carlisle and Finch Co., (513) 681-6080.

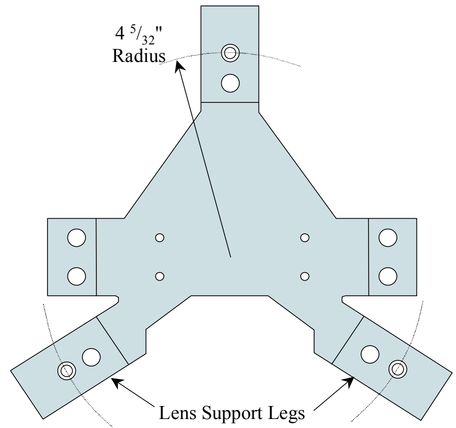
Data Sheet 6-E(21). (cont'd).

6.E.

Ice Buoy Lantern



Ice Buoy Lens



Ice Buoy Lantern Spider

Function. The ice buoy lantern is installed on lighted ice buoys, to provide a seasonal light signal in waters prone to heavy icing.

Features.

- Replaceable clear, red, green or yellow acrylic lenses.
- Lenses are modified to fit under a protective ice buoy dome (see Data Sheet 2-L(22)).
- No focusing adjustments.

Related Equipment. The ice buoy lantern is composed of a modified 140mm omnidirectional lens and a “lantern spider” that supports the lampchanger, flasher and lens. The ice buoy provides the housing for the lantern, replacing the lantern base. The ice buoy lantern is outfitted with a CG-6P lampchanger, standard 12-volt marine signal lamps (up to and including the 2.03 amp lamp), a CG-181/493 flasher, a WK-681 wiring kit, and a 12-volt daylight control (either the Type C or Type R, as appropriate).

Wiring and Installation. The power lead for the ice buoy lantern shall be a 42-inch length of 12/2 SO cable, with 6" of outer jacket stripped from each end. The power cable is passed through the stuffing tube on an ice buoy battery cover. The wires on the bottom side of the battery cover shall be terminated with ⅜" ring lugs. The other end of the leads shall be terminated with spring spade lugs. The wiring convention uses black for positive (+) and white for negative (-). Procedures for wiring and installing the ice buoy lantern in an ice buoy are outlined below.

Data Sheet 6-E(22). Ice Buoy Lantern

(1) Wire a CG-6P lampchanger and CG-181/493 flasher together, following the procedures in data sheet 6-E(6). The lampchanger and flasher are secured to the lantern spider, with the three lens support legs up, using four 10-32x1" screws. Install the appropriate (Type C or Type R) 12-volt daylight control.

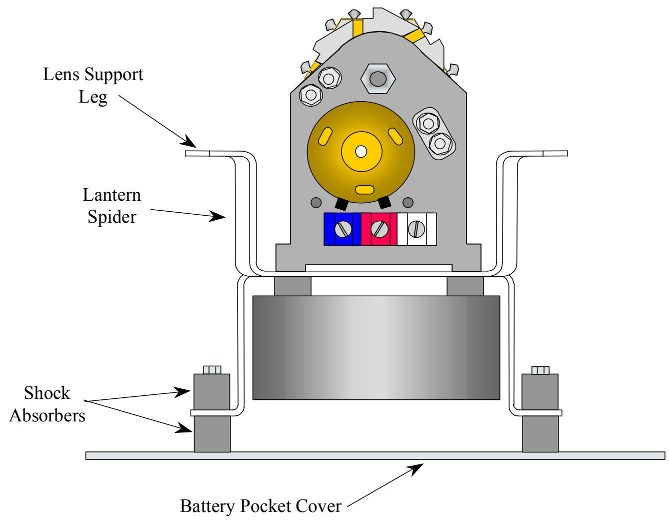


Figure 6-60. Installation of the Ice Buoy Lampchanger Bracket.

(2) Attach the spade lug-end of the power leads to the input terminals of the flasher.
(3) Install a rubber shock absorber over each pair of studs on the battery pocket cover.
(4) Mount the lampchanger/flasher assembly on the battery pocket cover.
(5) Install another set of rubber shock absorbers over each pair of studs, and secure with flat washers and lock nuts. Do not overtighten or the effectiveness of the shock absorbers will be negated.
(6) Install an ice buoy battery in the pocket of the buoy, and secure the battery clamps.
(7) Insure that the battery pocket gasket is in place on the battery pocket flange.
(8) Wire the power lead, using the ⅜" ring lugs, to the ice battery. Coil any extra wire in the pocket, and place the battery pocket cover over the studs on the battery pocket flange.
(9) Apply anti-seize lubricant to the studs and secure with stainless steel flat washers and lock nuts. Torque to 20 ft-lbs.
(10) Install the appropriate 12-volt marine signal lamps in the lampchanger. Rotate the lampchanger to the first position.
(11) Cover the daylight control and check the lantern operation.
(12) Mount an ice buoy lens on the three lens support legs of the spider bracket. Secure with stainless steel lock nuts. Do not overtighten, or the lens may crack.
(13) Install a new cork gasket over the ice dome mounting studs and apply anti-seize lubricant to the studs.
(14) Install the ice dome and a stainless steel clamping ring. Secure the clamping ring using stainless steel flat washers and lock nuts. Torque to 20 ft-lbs. **DO NOT OVERTIGHTEN.**

Data Sheet 6-E(22). (cont'd).

Performance. The performance characteristics of the ice buoy lantern are provided in Table 6-21.

Table 6-21
Ice Buoy Lantern Performance with 12-volt Lamps

NOMINAL RANGES (NMI) – ICE BUOY LANTERN

LENS	LAMP 12V	FL 2.5(0.3) FL (2+1) 6 Q	FL 4(0.4) FL (2) 5 Mo (A) (0.4, 2.0)	FL 6(0.6)	FL (2) 6 FL 2.5(1) ISO 2	ISO 6 OCC 4	FIX
CLEAR	0.25A	3	3	3	3	4	4
	0.55A	4	4	4	4	5	5
	0.77A	5	5	5	5	6	6
	1.15A	5	5	6	6	6	6
	2.03A	6	6	7	7	7	7
YELLOW	0.25A	3	3	3	3	3	3
	0.55A	3	4	4	4	4	4
	0.77A	4	4	5	5	5	5
	1.15A	5	5	5	5	6	6
	2.03A	5	6	6	6	7	7
RED	0.25A	2	2	2	2	2	2
	0.55A	2	3	3	3	3	3
	0.77A	3	3	4	4	4	4
	1.15A	4	4	4	4	4	5
	2.03A	4	4	5	5	5	5
GREEN	0.25A	2	2	2	2	2	2
	0.55A	3	3	3	3	3	3
	0.77A	3	4	4	4	4	4
	1.15A	4	4	4	4	5	5
	2.03A	4	4	5	5	5	6

LAMP CURRENT RATING (AMP)	0.25	0.55	0.77	1.15	2.03
VERTICAL DIVERGENCE (DEG)					
50% BEAM WIDTH	±2.4	±2.3	±2.0	±2.4	±2.7
15% BEAM WIDTH	±10	±4.0	±4.0	±4.0	±4.0

Note: Consult the Visual Signal Design Manual for intensities.

Dimensions. The overall height of the ice buoy lens is 5 ¾" tall. It is a modified 140mm lantern lens, where the upper 1/3 of the lens has been cut off and replaced with a flat acrylic plate. This allows the lens to fit under the ice buoy dome. The plastic hinge has also been cut off, as it is not needed inside the ice buoy lantern housing.

Additional Data. The ice buoy lenses are available as Commercial-Off-The-Shelf (COTS) items from Tideland Signal Corporation, (713) 681-6101. The Tideland part numbers are as follows:

- Ice Buoy Lenses:
  - Clear..........................302.1033-00
  - Red.............................302.1033-01
  - Yellow.........................302.1033-03
  - Green..........................302.1033-04

The ice buoy lantern spider is stocked at Engineering Center Baltimore, under National Stock Number (NSN) 5340-01-132-5376.

Data Sheet 6-E(22). (cont'd).

Function. The XFB series xenon flashtube beacons provide a momentary, intense flash that improves the conspicuity of an aid. The xenon flashtube beacon must be used in conjunction with a standard light signal, as the short duration of the flash makes it difficult to visually determine the position of the aid. Xenon flashtube beacons are predominantly used on sea buoys, and on some vessel traffic separation buoys.

WARNING: Hazardous voltages are present in XFB series xenon flashtube beacons. The power supply provides a 400-volt pulse across the "T" and "G" terminals to a transformer in the flash head. The potential across power-supply terminals "A" and "K" builds from approximately 40-volts to 365-volts over a one-second period prior to each flash. After power is disconnected, allow fifteen (15) minutes for the energy storage circuit (capacitors) to discharge, or discharge the capacitors by installing an insulated jumper across terminals "A" and "K."

Features.

- Designed for 10 to 15-volt DC operation.
- Three versions available (designated by output in Joules per flash): XFB-001, XFB-005 and XFB-010.
- Comprised of two components—the flash head, and the power supply unit.
- Field-replaceable timer PROM on programmable timer board.
- Mounts in the 155mm buoy lantern using standard 155mm lampchanger bracket.
- Minimum flash rhythm of 1 second, with a 200 microsecond flash duration.
- Provisions for daylight control.

Data Sheet 6-E(23). Xenon Flashtube Beacon

Electrical and Mechanical Characteristics.

- Input voltage ....10 to 15 volts DC
- Maximum current draw..........2.5 amps (XFB-005 and XFB-010)
- Height
  Completed assembly ....12" (305mm)
  Power Unit ....5" (127mm)
  Flash Head ....3½" (89mm)
- Diameter.................................5" (127mm)
- Weight
  Power Unit ....2.5 lbs (1.14kg)
  Flash Head ....0.6 lbs (0.27kg)

Related equipment. The XFB series xenon flashtube beacons must be installed in a 155mm lantern, and is mounted to a standard 155mm lampchanger bracket. However, the bracket is installed "upside down." Xenon flashtube beacons improve the conspicuity of an aid, and must be used in conjunction with a standard 155mm lantern. The beacon uses standard Type C or Type R 12-volt daylight controls, as appropriate.

Wiring. Figure 6-61 illustrates the wiring schematic for the xenon flashtube beacon.

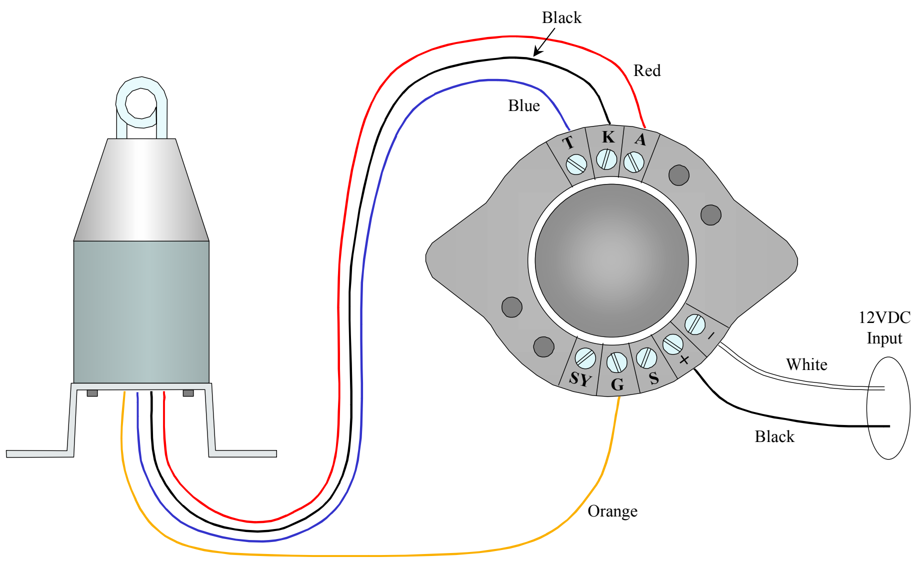


Figure 6-61. Wiring Schematic for the Xenon Flashtube Beacon

Installation. Use four 10-32 x ½" screws to mount the flash head assembly and power supply unit to an inverted 155mm lampchanger bracket. The flash head assembly comes with a standoff, to raise the flashtube to the focal plane of the lens. The flash head/power supply assembly is then mounted on the bracket supports in the 155mm lantern base. Follow instructions for in Data Sheet 6-E(13) to mount the lantern on a buoy.

Data Sheet 6-E(23). (cont'd).

Focusing. The 155mm lantern is a prefocused optic, the focus is not adjustable. Inspect the lampchanger bracket and flash head standoff to insure that they are not bent. Install the flash head/power supply assembly with the lock washers on top of the lampchanger bracket.

Performance. The performance characteristics of the 155mm buoy lantern outfitted with the xenon flashtube beacon are provided in Table 6-22.

Table 6-22
Xenon Flashtube Beacon Performance in a 155mm Lantern

Mean horizontal intensity (cd)	XFB-001	XFB-050	XFB-010
clear lens	85	425	850
red lens	26	130	250
green lens	27	135	270
yellow lens	58	290	580

Additional Data. The XFB series xenon flashtube beacons and components may be purchased as commercial-off-the-shelf (COTS) items from Automatic Power, Inc. (API), (713) 228-5208. The original version of the XFB series flash head has the flashtube potted to the flash head assembly. API has developed a new version, for use in non-explosive environments, which allows for replacement of the flashtube. The following are applicable API part numbers for the beacon components:

- Power Supply Unit:

  XFB-010 9010-0186
  XFB-050 9010-0185
  XFB-010 9010-0181

- Flash Head:

  Potted version.............9001-0295
  Non-potted version.....9001-0641
  Lamp assembly...........9001-0639 (for use with non-potted version only)
  Lower assembly ....9001-0640 (non-potted version, without the lamp assembly)

Instructions on computing the power requirements of the XFB series beacons are detailed in Chapter 5 of the Solar Design Manual.

Data Sheet 6-E(23). (cont'd).

Self Contained LED Lantern

701 702 702-5

Function. The Carmanah 700 series solar powered lanterns are suitable for use on aids to navigation needing a nominal range of 3 nautical miles or less. The lantern is self-contained, housing all the components necessary to provide a marine signal with no additional apparatus. It is specifically adapted for use on the recently modified 5th class foam buoy, and this buoy/lantern combination is intended as the modern replacement for the old lighted discrepancy buoy, which will be discontinued. Lantern selection is determined by the manufacturer based on its intended flash rhythm and installation area (i.e., the 702 lantern may be required in some locations in CGD1, CGD9, CGD13 and CGD17)

Features.

- Bolts to existing lantern stands sized for 155mm lanterns.
- Self-contained optic, flasher, battery, solar panels and daylight control.
- Replaceable components.
- 3 year prorated warranty.

Related Equipment. Carmanah external battery charger, TV remote or Carmanah programmer.

Charging. The lanterns are charged prior to shipment. If it is not installed within two months of receipt, and at 6-month intervals during long-term storage, the lantern shall be recharged as prescribed below.

Remove the lantern from the shipping container. It should arrive programmed OFF, (i.e., it will not flash in a darkened room). Place the lantern outside in direct sunlight. The battery will be recharged (with the unit programmed OFF) in 60 hours of direct sunlight. 60 hours does not include nighttime, so if the lantern receives sun for 6 hours per day, it will take 10 days for it to fully charge up.

An alternative is to purchase an external charger from Carmanah and the access tool for the tamper resistant Allen screw (see our website: http://www.uscg.mil/systems/gse/gse2; the 5/32" tamper resistant Allen wrench may be purchased from Carmanah or McMaster Carr Supply Company, 732-329-3200, part number 7390A27). The charger will recharge the battery in a fraction of the time, however <u>specific procedures must be followed</u> or damage to the battery and/or control unit will occur.

- Use the modified Allen wrench to remove the four fasteners from the top of the lantern.
- Disconnect the connector to the solar panels. This will allow you to separate the base from the optic head (it is important that the solar panel is disconnected first).
- Disconnect the connector to the batteries.
- Attach the proper external charger pigtail to the connector feeding the battery.
- Measure the voltage at the pigtail.
- Based on the voltage measurement, charge the battery in a well ventilated area for the following amount of time:

701 Lantern (15 amp-hours)	702 & 702-5 Lanterns (24 amp-hours)
4.14 volts or higher - 5 hours	7 hours
3.98 volts to 4.13 volts - 15 hours	18 hours
3.86 volts or lower - 20 hours	27 hours

Do not charge the battery longer than the time specified. Overcharging can cause hydrogen gas to vent, which can consequently reduce the battery life.
Make sure that the plugs on the charger do not touch each other.

- Replace the gasket if the lantern was previously in service. The gasket needs to be perfectly seated in the channel. Start at the corners and work in towards the center of each side.
- Reconnect the battery wires first.
- Then reconnect the solar panel wires.
- Secure the optic head with the vandal proof machine screws. Tighten them very well in order to insure the proper seal between the gasket and the housing.

<u>Programming</u>. The color of the lantern cannot be identified by the appearance of the lens or LEDs when they are off. A colored dot will be painted on the plate mounted in the lens near the serial number, company name and address. On 702-5 lanterns, the dot will be painted beneath the base.

Data Sheet 6-E(24). (cont'd).

A LED lantern programming shroud, (essentially a wrap that covers the solar panels but leaves the lens area open for programming and visual confirmation of the flash rhythm) may be fabricated from any opaque material. This cover is necessary to check the daylight control function of the Carmanah LED lantern after installation and should be used to program the proper flash rhythm before initial deployment. Programming is accomplished with a TV remote control set to communicate with the lantern. If the lantern does not respond to the controller, or if the batteries are removed, reprogram the controller by pressing CODE SEARCH until the red light comes on, then the TV button, then enter 0 0 6.

Programming is accomplished after the lantern changes from day/night or night/day. It is preferable to program the lantern in the night mode, out of direct sunlight and strong indoor lights.

If stored in a brightly lit area, cover the lantern by placing the shroud around the solar panels, and the top solar panel (702-5 only). If stored in a dark area, move to a brightly lit area and wait 2 minutes, then cover the lantern, as described above. If the lantern does not respond to programming, move the lantern from dark to light and light to dark a few times to "wake up" the processor.

Programming must be started within 1 minute. The lantern responds after <u>each</u> entry with a 1/4-second flash. A double flash means it did not recognized the entry. Reenter that number until the correct confirmation is displayed.

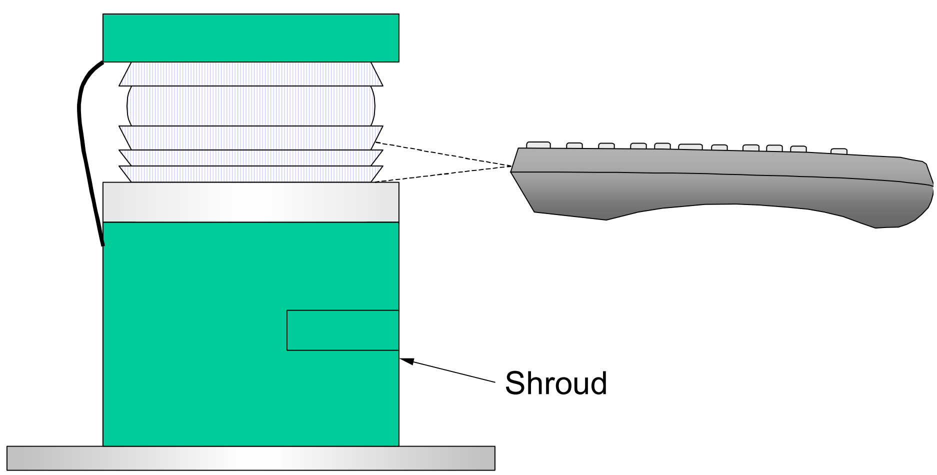


Figure 6-62.

- **Aim the controller at the lower portion of the lens, as shown in Figure 6-62.**

- **Enter the security code**: POWER, 7 5 3, CHAN^. After CHAN^ a flash followed by a very quick flash indicates successful entry of the security code.

Data Sheet 6-E(24). (cont'd).

6E.

- **Enter code 911:** POWER, 9 1 1, CHAN^. 9 1 1 is intended to clear the memory of all previously entered codes, and to introduce a known, cleared state. If the light is transitioned and not cleared of its OFF code, it will turn itself off again due to the instruction it has in memory.

- **Enter the security code again** before entering the desired rhythm: POWER, 7 5 3, CHAN^.

- **Enter the desired rhythm**: POWER, # # #, CHAN^.

  The following codes refer to our standard rhythms. More rhythms are detailed in the instruction manual supplied with the lantern:

014	FL(2)6	**073**	FL6(0.6)	**129**	Q
022	FL(2+1)6	**081**	Iso 6	**175**	FL(2)5
049	FL2.5(0.3)	**095**	Mo(A)	**000**	OFF (for storage)
063	FL4(0.5)*	**118**	Oc 4		

*Slightly different than our standard FL4(.4) rhythm, but will be similar in appearance.

Check the rhythm with your watch and bench test for 8-24 hours with the shroud on. If the beacon will not be deployed within 1-2 days, then remove the shroud and store outside in the sun or program the lantern to OFF, as described above.

Installation. The lantern may be installed on the recently modified 5th class lighted foam buoys, structures and steel buoys where the operational range requirements are met for the specific color and flash rhythm. Three bolts protruding from the top-plate of the buoy or three leveling studs on structures are used to secure the lantern. However, the bolts will shadow the solar panels if they extend too far. Therefore, install three nuts on the bolts (similar to installing a lantern on a structure) so that about 1" of thread is exposed. Be sure that the nuts are the same distance from the top-plate so that the lantern is "level" on the buoy. On structures, place a torpedo level on the base plate of the lantern. Adjust the leveling studs so that lantern is level in two directions. Use the "T" method described in COMDTINST M16500.19A, Short Range Aids to Navigation Guide.

Be sure the lantern is properly programmed prior to installation. Install the lantern on the bolts and secure with a lock washer and nut, as shown in Figure 6-63.

If the lantern is installed directly on the top-plate of a steel buoy with bolts facing down (to minimize the protrusion), install an insulating nylon washer on each bolt between the lantern and top-plate to prevent crevice corrosion.

Data Sheet 6-E(24). (cont'd).

6E.

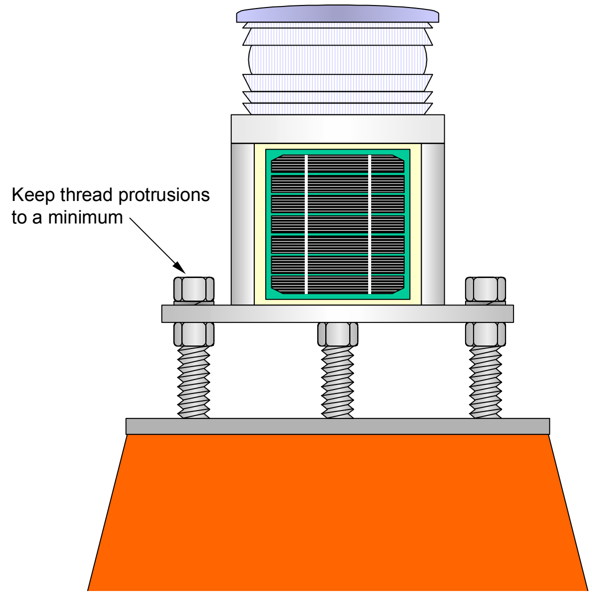


Figure 6-63.

Performance Characteristics. The performance characteristics of the 700 Series LED buoy lantern are provided in Table 6-23.

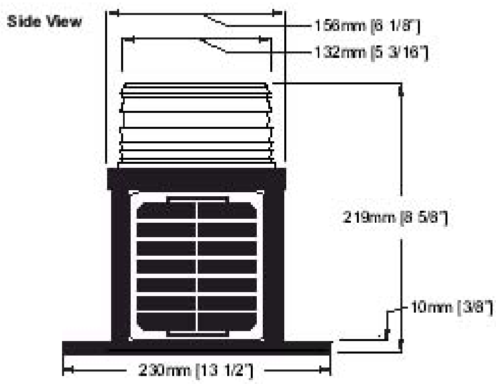
Table 6-23
NOMINAL RANGES (NMI) – Carmanah 700 Series LED Lantern

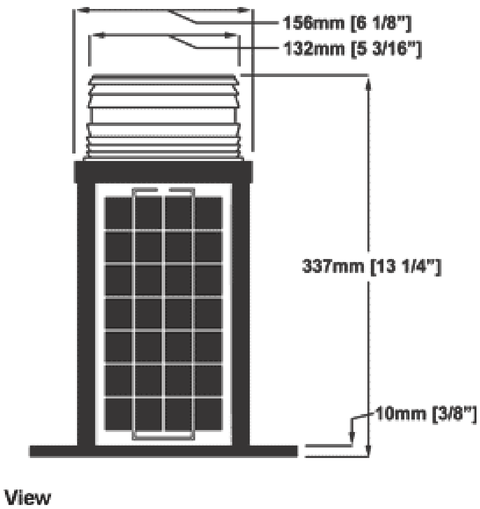
Color		FL 2.5(0.3) FL (2+1) 6 Q	FL 4(0.4) FL (2) 5 Mo (A)	FL 6(0.6)	FL (2) 6 ISO 2	ISO 6 OCC 4	FIX
White		3	3	3	3	3	2
Yellow		3	3	3	3	3	2
Red		3	3	3	3	3	2
Green		3	3	3	3	3	2

Vertical divergence (degrees)	Red	Green
50% beam width	±2.8	±3.5
15% beam width	±8.9	±9.5

Dimensions. The dimensions of the lantern depend on which version is purchased. The overall dimensions of the 701, 702 and 702-5 lanterns are illustrated in figure 6-64. The weight is approximately 12 lbs for the 701 lantern and 17 lbs for the 702 and 702-5.

Data Sheet 6-E(24). (cont'd).





701 702 & 702-5

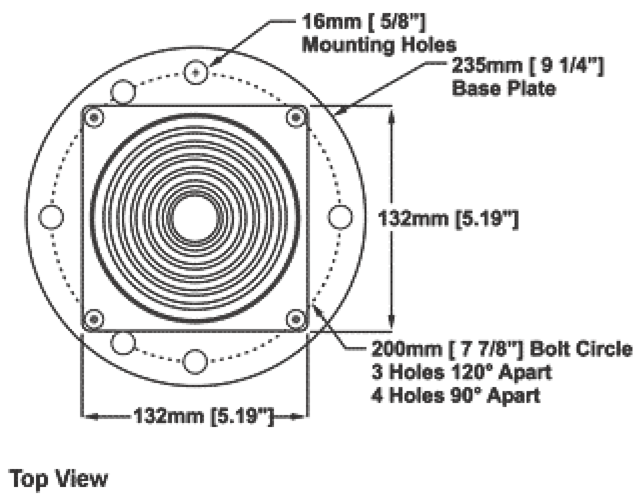


Figure 6-64. 701, 702 and 702-5 Carmanah Lanterns

Service Life. LED lanterns generally do not burn out, but light output degrades over time to a point that the light may not meet the operational range. Therefore lanterns shall be removed from service according to the following schedule:

Duty Cycle	**Service Life (nighttime operation)**
10% to 29%	12 years
30%-100%	8 years

Although overall battery life is yet to be determined through field trials, schedule replacement of

Data Sheet 6-E(24). (cont'd).

6E.

the battery pack to coincide with the service life of the lantern, not to exceed 4 years. For example, a **FL6(.6)** rhythm has a 10% duty and a service life of 12 years. Schedule replacement of the battery pack at 4-year intervals.

Additional Data. Lanterns are manufactured by Carmanah Technologies Inc, Building 4, 203 Harbour Road, Victoria, British Columbia, Canada V9A 3S2, phone: (877) 722-8877, website: http://www.carmanah.com. Lanterns should be purchased by phone using a Government credit card to obtain the Coast Guard price. They are available in three versions, the 701, 702 and 702-5 series. All three produce the same intensity; the difference is the size of the solar panels and internal battery. Based on the intended location and flash rhythm, Carmanah will determine which lantern is suitable for the application. Generally, northern latitudes with high duty cycle rhythms require either the 702 or 702-5 series lantern. The buyer specifies the color (red, green, white or yellow), but not the flash rhythm; depending on the intended location, the rhythm is programmed by the CG unit. A dedicated TV remote or Carmanah Programmer is required to set the proper flash rhythm.

Prices for the lanterns are available on the Carmanah website. Prices for replacement components, an external battery charger and programmer (if a spare TV remote is not available) are listed on the G-SEC-2 website: http://www.uscg.mil/systems/gse/gse2 under Products/Services, Aids to Navigation Equipment List, Lantern, LED.

Data Sheet 6-E(24). (cont'd).

7.C.3.b.(1).

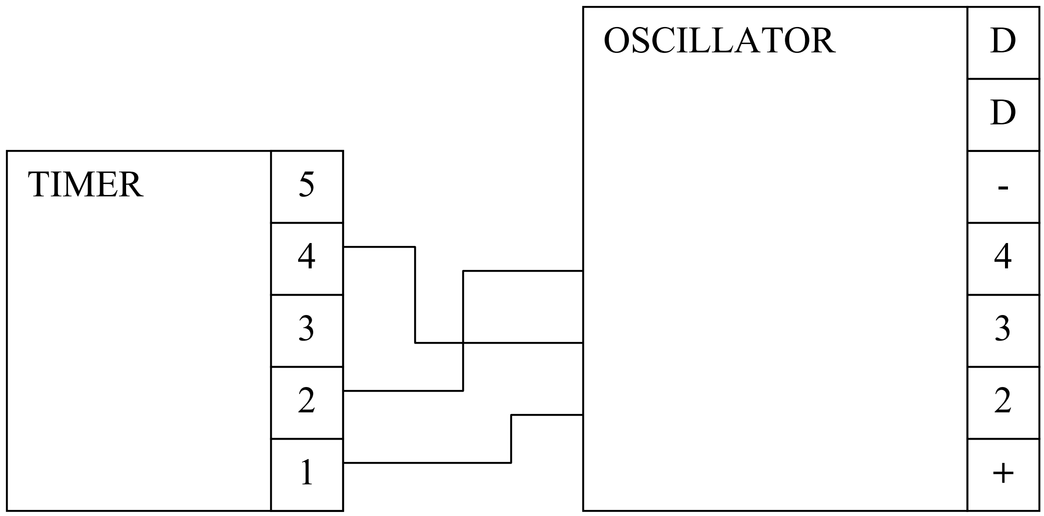


Figure 7-8A. Wiring diagram for the Timer and the Oscillator.

Table 9-3
Installation Correction Factor ($Install_{cf}$)

Battery Service Life at 13 hrs/day (Bcc/Dcc)				$Install_{cf}$ (days)
365-390	721-735	736-750	1081-1095	0
391-420	691-720	751-780	1051-1080	10
421-450	661-690	781-810	1021-1050	20
451-480	631-660	811-840	991-1020	30
481-510	601-630	841-870	961-990	40
511-540	571-600	871-900	931-960	50
541-553	556-570	901-915	916-930	60

Table 9-4
Environmental Correction Factors (Env_{cf})

Correction Factor	Env_{cf} (days)
Heavier than average daily cloud cover in:	
CGD1, upper CGD5 and upper CGD9	15
CGD13 and CGD17	30
Average daytime temperature over 80°F for entire RBDT	30
Daylight control shaded at sunrise	30
Daylight control shaded at sunset	30
Average nighttime temperature less than 30°F during 3 or more months of RBDT	15

Table 9-5
Average Lamp Current in Amperes
for Rated Lamp Sizes

Rhythm	Duty Cycle(%)	0.25a	0.55a	0.77a	1.15a	2.03a	3.05a
Fixed	100	.250	.550	.770	1.15	2.03	3.05
Oc 4	75	.252	.559	.785	1.18	2.10	3.17
Iso 6	50	.252	.559	.785	1.18	2.10	3.17
Fl(2)6	33	.258	.578	.816	1.24	2.23	3.42
Q	30	.278	.639	.916	1.42	2.76	
Mo(A)	30	.262	.592	.844	1.29	2.38	3.70
Fl2(5)	16	.271	.621	.894	1.38	2.62	4.15
Fl(2+1)6	15	.278	.639	.916	1.42	2.76	
Fl 2.5(.3)	12	.278	.639	.916	1.42	2.76	
Fl 4(.4)	10	.271	.621	.894	1.38	2.62	4.15
Fl 6(.6)	10	.266	.596	.859	1.31	2.45	3.81

Example: What is the RBDT of a buoy using a 1000 Ah BPU with 0.55 amp lamps and a FL4(.4) flasher with daylight control? The buoy will be installed in the First Coast Guard district.

Dcc = 0.621 amps x 0.10 x 13 hr/day + 0.48 Ah/day

Dcc = 1.287 Ah/day

Bc/Dcc = 1000Ah / 1.287 Ah/day = 777 days

Install_{cf} = 10 days

Env_{cf} = 15 days

RBDT = 777 days - 10 days - 15 days

RBDT = 752 days or 2 + 22 yr/days.

CG-6P lamp life = 4 + 65 (Table 9-6; not a factor in determining this RBDT) and use of 0.55 amp lamps is acceptable with a 1000 Ah BPU (Table 9-2)

A 2000 Ah BPU would provide a RBDT in excess of 3 years, exceeding the maximum allowable interval.

(d) Lamp Life. For some flasher/lamp combinations, the rated life of six lamps in the CG-6P lampchanger will be less than the RBDT. In some cases, a special notation shall be made on the ATONIS form to indicate that lamp replacement time is less than the RBDT. See chapter 6 for the lamp life calculations to determine the replacement interval for the lamp/flash rhythm combination.

(e) Activation. All primary batteries, with the exception of dry cell batteries (ice batteries) require air to function. Remove sealing tape covering vents prior to use (including buoy power units).

(4) Special Applications.

(a) Ice Buoys. Especially designed dry-cell type primary batteries (Data Sheet 9-E(21) are authorized for use in ice buoys. These batteries have a very short shelf life and for this reason, their storage is limited to one season (regardless if whether they are used). Ice buoys do not have vented pockets because they frequently submerge and this, together with the shock loads encountered, precludes the use of air-depolarized batteries. Table 9-6 provides calculated RBDTs for standard lamp/flasher combinations used on ice buoys.

(b) Emergency Use. Surplus ice buoy batteries can be used as emergency temporary power sources (Hot Packs) on aids to navigation if:

- An accurate RBDT record exists which permits projection of expected remaining service life, and;
- The battery output voltage is greater than 11.0 volts when load tested in accordance with COMDTINST M16500.19A, Short Range Aids to Navigation Servicing Guide.

Table 9-6
Ice Buoy Battery RBDT (in days)

	Lamp Rating (amps)		
Rhythm	.25a	.55a	.77a
Fixed	75		
Oc 4	115		
Iso 6	180		
Fl(2)6	180	115	
Q	180	115	
Mo(A)	180	115	
Fl (2)5	180	180	150
Fl (2+1)6	180	180	160
Fl 2.5(.3)	180	180	180
Fl 4(.4)	180	180	180
Fl6 (.6)	180	180	180

d. Secondary Batteries. Secondary batteries are batteries that can be recharged by either a battery charger or photovoltaic (solar) array. Nickel-cadmium batteries are used to provide DC power for diesel starting, and power for emergency light and sound signals. Lead-acid batteries are used primarily on solar power aids.

(1) Diesel Starting Batteries. 24-volt nickel-cadmium batteries are used at prime-powered (1 remaining) and commercially powered sites requiring a backup engine-generator. Twenty 1.2-volt pocket plate type cells are wired in series to achieve 24 volts. The battery is specifically designed for long float service and capable of starting a diesel engine. See Data Sheet 9-E(6).

(2) Emergency Batteries. 12-volt nickel-cadmium batteries are used at some commercially powered and solar powered sites to provide backup power for emergency signals. Ten 1.2-volt pocket-plate type cells are wired in series to achieve 12-volts. This battery was chosen because it retains its capacity over a long period of time (in excess of 20 years) and is capable of being float charged by a battery charger or non-standard solar panel. Battery capacity should be selected to provide a minimum of 8 days autonomy based on an 11.0-volt cutoff voltage. See COMDTINST M16500.8A, Automation Technical Guidelines for additional information. See Data Sheet 9-E(8).

(3) Photovoltaic (Solar) Batteries. Secondary batteries used in solar power applications are design to provide small amounts of current over along period of time. The batteries look similar to automotive batteries, which are designed to deliver large amounts of current in short periods of time. Use of automotive type batteries in AtoN will likely lead to premature failure.

(a) Maintenance-Free 12-volt Batteries. Batteries with a nominal rating of 12 volts, 100 ampere-hours are used on all solar powered buoys and most structures. Data sheets 9-E(40) and 9-E(41) detail two commonly used solar batteries. COMDTINST M16500.24 lists additional suggested sources of supply.

(b) Large Battery Systems. These batteries are used at stationary aids to navigation requiring more than 400 amp-hours. Six 2-volt cells are wired in series for a nominal 12-volt system. Data sheets 9-E(47) and 9-E(48) detail two large battery systems.

(4) Emergency Use. Solar batteries may be used as Hot Pack batteries as long as the following conditions are met:

(a) The battery is sealed;

(b) Permanently marked “For Discrepancy Use Only”;

(c) Derated to one half of advertised capacity;

(d) Protected from rain, sun and salt spray, if possible;

(e) Recharged as soon as it is removed from the aid.

Table 9-7 details the RBDT when using one solar battery to temporarily power these common daylight controlled light signals.

Hot Pack* RBDT in Days

Flash Rhythm	Lamp Size 0.25	0.55	0.77	1.15
Fl 6(.6)	57	36	28	20
Fl 4(.4)	56	35	27	20
Fl 2.5(.3)	51	31	23	16
Fl (2+1)6	45	26	20	14
Fl (2)5	44	25	19	13
Fl 4(1.0)	34	19	14	10
MO A	30	16	12	8
Fl (2)6	28	15	11	8
Q	29	15	11	7
Iso 6	21	11	8	5
Occ 4	15	7	5	4

*Using one 12 volt, 100 AH secondary battery

Table 9-7. Hot Pack RBDT in Days

e. Solar Power System. A minor aids solar power system consists of solar panel(s), rechargeable (secondary) batteries and mounting hardware. Systems are designed using the Solar Design Program (COMDTINST M16500.24) so that the minimum seasonal state of charge does not drop below 65% (80% for large battery systems) during an unusually harsh year. Minor aid systems do not use a charge controller as the solar panels are closely matched to the charging characteristics of lead-acid secondary batteries as long as the charge rate is within specified limits, as detailed by the Solar Design Program.

In general, solar power systems can be designed to work wherever there is sunlight. Sites shadowed by cliffs, or bluffs can, in some cases, be overpowered to compensate for the lack of direct sunlight, otherwise they must use primary batteries. Contact COMDT (G-SEC-2A) for assistance.

Solar power systems for large installations contain multiple solar panels, Local Terminal Boxes (LTBs), a PV Combiner box, large battery systems, charge controllers and a Solar Distribution Box (SDB). COMDTINST M16500.24 and COMDTINST M16500.8A provide more detail on the design and installation of these systems. The Solar Lighthouse Spare Parts Kit, available from Commandant (G-SEC), contains components commonly replaced or hard to find at solar powered lighthouses.

Solar power systems can be divided into three basic types: minor aid, lighthouse and range. The minor aid power system is the simplest and is depicted in Figure 9-6. These systems have one or two solar panels and up to four solar batteries. Some range power systems are considered minor power systems.

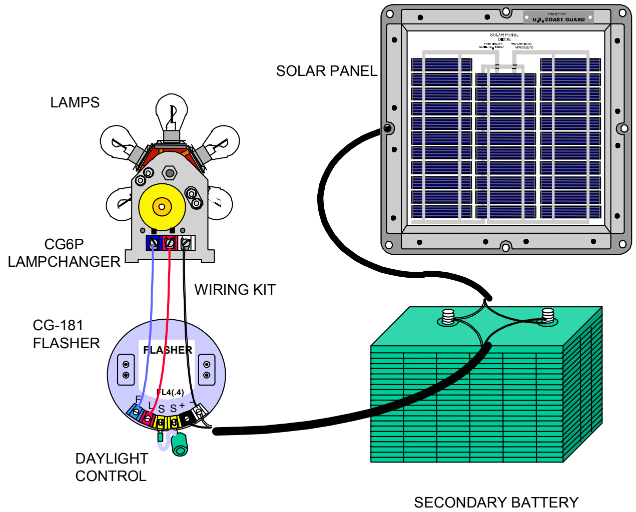


Figure 9-6. Typical Minor Aid System

Lighthouse power systems are more complex. Most have multiple solar panels, a charge controller to prevent overcharging the battery, a large 12 VDC battery system comprised of six two volt cells wired in series, and multiple loads controlled by a central distribution box. Figure 9-7 depicts a typical lighthouse power system. Some high intensity day/night ranges may use some of these components.

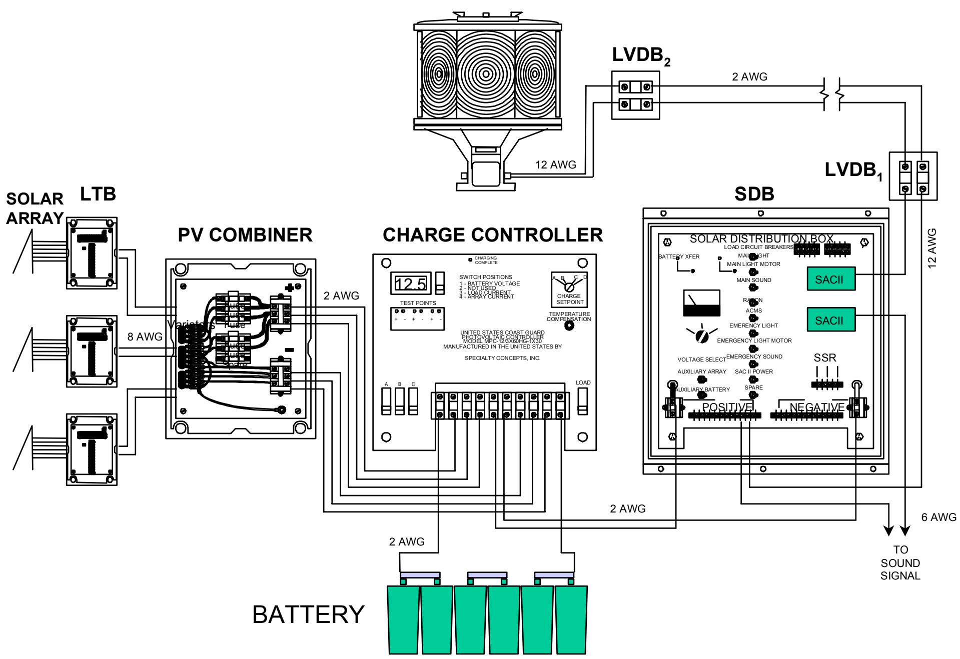


Figure 9-7. Typical Lighthouse Power System

The range power system is typically used on high intensity nighttime ranges and day/night ranges. It may also be used at lights containing up to eight solar panels. The system is comprised of up to eight solar panels, and a Range Power Box (RPB) to prevent overcharging the battery and provide low voltage protection, and a Range Switch Box-DC (RSB-DC) for day/night ranges. Figure 9-8 depicts a typical range power system. The Range Spare Parts Kit, available from Commandant (G-SEC), contains hardware commonly replaced on both AC and DC powered day/night ranges.

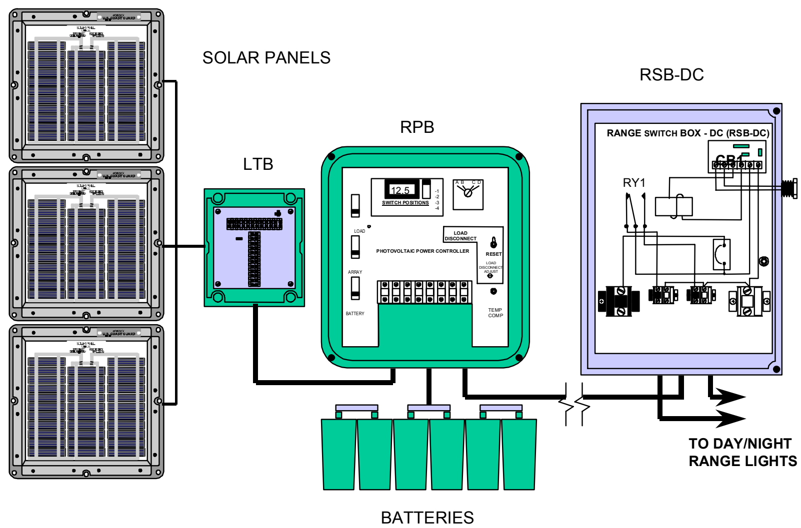


Figure 9-8. Typical Range Power System

(5) Solar Panels. Solar panels are photovoltaic devices that convert sunlight into direct current (DC) electricity. The energy produced by the solar panel during the day charges the secondary battery that powers the day or night (or both) load. Three types of solar panels are available: standard, SM46 and SM50-H. Standard panels are available in 10 watts, 20 watts and 35 watts. These panels are designed to withstand the vigors of operation on lighted aids to navigation. The SM46 (old M65) panel is a commercially available module that is used on protected structures requiring high-density packaging. These panels are rated at 46 watts, but are not robust enough for installation at exposed lighthouses. A single SM50-H (old M75) is used at solar powered installations requiring emergency batteries. The higher voltage of this panel is ideally suited to float charge nickel-cadmium batteries. See Data Sheet

Consult COMDTINST M16500.24, Solar Design Manual to determine the proper wire size for all wire runs.

e. Photovoltaic (Solar) Batteries – Minor Aid Systems.

(1) Storage. Batteries shall be stored upright in a clean, dry place. Lead-acid and nicad batteries shall never be stored together. Extreme care must be used when transporting lead-acid batteries in the vicinity if primary or nicad batteries. The electrolyte, a strong acid in lead-acid batteries and a strong base in nicads and primary batteries which, if mixed can cause a violent thermal reaction.

Storage temperatures above 75^{o} F cause a high self-discharge rate and grid corrosion, which can affect shelf life and lead to premature failure of batteries. Batteries may be stored outside in an environmentally protected location not subjected to high temperatures. The storage temperature for batteries should be above –20^{o}F to prevent freezing. Never rest tools or store metallic objects above a battery where they could fall and come into contact with terminals and short out the battery.

(2) Tracking. Battery tracking labels (Data Sheet 9-E(43)) shall be applied to each battery. The appropriate information shall be recorded in the battery tracking log.

(3) Shelf Life. Lead-acid batteries can remain on the shelf as long as they are maintained at full charge. Therefore, batteries stored on the shelf shall be recharged at 6-month intervals. Records shall be maintained as to which batteries are charged and the date. Batteries that have been in storage should be placed in service before newly received batteries.

(4) Handling. Servicing personnel should take care to avoid contact with electrolyte and should use eye protection and leather or rubber gloves when handling batteries. When near batteries, do not smoke, light a flame or generate sparks with hand or electric tools as the battery may be venting explosive hydrogen gas. Do not lift batteries by the terminals. Use the supplied handle or a "firewood" type carrier to transport the battery. Friction type carriers and carriers that insert into finger grips are not approved for overhead lifting. Keep liquid electrolyte batteries in

upright position to prevent electrolyte spillage.

(5) Charging. Batteries shall be fully recharged prior to installation if installed more than two months after manufacture or last documented recharge. Batteries should be charged individually using a Power-Mark MPX1210T (860-927-3930) or equivalent battery charger. Multiple batteries of the same type may be maintained at full charge using the Power-Mark charger after they are charged.

Hydrogen gas is formed during charging of these storage batteries. Some batteries are sealed, but contain pressure vents that open when they are overcharged. In any event, batteries should be expected to vent hydrogen gas when charging. Hydrogen gas is highly flammable, is lighter than air and will rise to the highest available space. Therefore, areas designated for service, storage and charging of batteries must be designed to:

(a) Vent gas to exterior atmosphere;

(b) Prevent ignition of such gases that might not be completely vented.

(5) Charging Area Requirements. Floating units requiring battery charging shall have their batteries charged ashore, on deck or in a designated charging area prior to installation. At shore units, battery charging may take place outdoors under natural ventilation when climate conditions permit. An overhead shelter is recommended to give protection from the elements. At shore units where battery charging can not be accomplished outdoors, a battery charging room, must be provided that meets the requirements of NFPA 303 (available from MLC (mis), Inspection and Safety). These requirements detail ventilation of hydrogen gas to the outside atmosphere, ignition prevention of any unvented gas and other related precautions. Ventilation requirements for battery charging rooms when charging nicad and lead-acid batteries may be calculated as follows:

$C = 0.00027 \times N \times I \times 60 \times n$

Where: **C** is the amount of hydrogen produced in ft^3/hr/ampere/cell;

and skin. Batteries being removed from service after several years of operation may contain electrolyte on the case. Personnel charging secondary batteries shall wear rubber gloves, splash proof goggles or full-face shield (preferred) and a rubber apron. Personnel handling batteries being installed or removed from service shall wear eye protection and rubber (preferred) or leather gloves (leather gloves should be inspected periodically for deterioration and discarded or cleaned immediately if wetted by electrolyte).

(b) Treatment for Electrolyte Burns. If lead acid electrolyte comes into contact with skin, the affected area should be washed immediately with freely running water for at least fifteen minutes to dilute and wash away the acid. Compresses of baking soda may be used on electrolyte burns. Severe skin burns should be examined and treated by a doctor. Any electrolyte in the eye should be washed out immediately with large quantities of water using either a potable eye wash station or emergency eye wash station. If not available or contaminated, use clean potable water by gently pouring cupful after cupful of water into the corner of the eye of a prone patient and letting it run off the other side. Continue this process for at least fifteen minutes. Cover both eyes with a sterile compress (to minimize eye movement) and get medical attention at once. Neutralizing solutions should not be placed in the eyes.

(8) Battery Installation. All solar batteries to be installed at a site should be matched by manufacturer, date of manufacture and recharged at the same time prior to installation. All minor batteries shall be load tested individually in accordance with the Short Range Aids to Navigation Servicing Guide COMDTINST M16500.19A prior to transport to the aid. Batteries should be installed in a level, upright position to prevent premature battery failure. Large, wet solar batteries (Yuasa EJ and FHGS series) should have a containment trough beneath the battery rack to capture and neutralize electrolyte. Wiring between batteries or cells should be made with supplied buss bars or 12/2 SO cable. After connections are made,

coat each terminal with an anti-corrosion agent such as No-Ox grease or petroleum jelly. Place a battery installation label (Data sheet 9-E(42)) on all minor aid solar batteries (optional), and enter the aid location in the battery tracking log.

(a) Structure Installation. Minor aid batteries shall be installed within standard Coast Guard battery boxes The small Coast Guard battery box protects batteries from the elements and can hold up to two minor aid batteries, the large battery box up to four batteries. Each battery box has built-in vents to vent hydrogen gas. During installation, ensure that all vents are clear. Chocking of batteries is required on structures subjected to vibrations that could cause significant battery motion inside the box and lead to premature failure due to loose connections. Batteries should be elevated above battery box mounting bolts with plywood to prevent localized cooling of the bottom of the battery in cold climates. Commercially available single battery boxes may be used as long as they are not black (interior gets too hot when in direct sunlight).

Power systems requiring more than 100 ampere-hours will have a number of 12-volt, 100 ampere-hour batteries connected in parallel to provide the proper capacity. For example, an aid requiring 200 ampere-hours of capacity will have two batteries wired in parallel, as shown in Figure 9-13 (note that power cable (SO) is taken from opposite corners of batteries). Shore aids requiring more than 400 ampere-hours should use large secondary batteries (Data Sheets 9-E(46) and 9-E(49)).

Large secondary batteries used on minor aids should be housed in a structure or custom-built vented battery box. Wet batteries (Yuasa, Fulmen) shall only be used on rock-solid platforms. Monopoles are not considered steady enough for these batteries. Wet batteries are preferred over absorbed (GNB, Dryfit) for longevity reasons

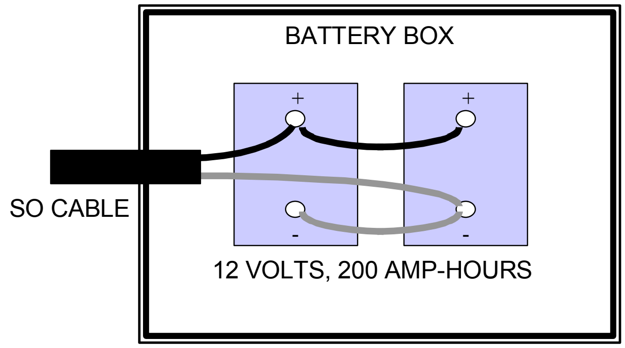


Figure 9-13

(b) Buoy Installation. Installation of wet batteries (Delco) into the battery rack or battery box requires careful handling and a short laydown time (four hours or less) to reduce the chances of electrolyte leakage. Batteries shall be installed with the axis of the battery length parallel to the buoy deck and the battery vent facing up (Delco) to prevent electrolyte spillage (see Figure 9-14). Up to 10 batteries installed in buoy pockets may be wired in parallel to provide the desired storage capacity or up to two batteries when installed in the whistle stand mounted battery box.

Buoy pockets are vented to allow hydrogen gas to escape. Vent pipes must remain clear and free of obstructions to allow adequate ventilation. Precautions shall be taken to prevent open flames, sparks, electric arcs or smoking in the immediate vicinity of the pocket, especially when first opened. Pockets should be allowed to air out for a few minutes until work is performed on the rack or batteries. If vent pipes become obstructed, hydrogen gas could collect in the pocket and present an explosive hazard.

Battery boxes contain vent and drain holes. Be sure these areas are free of obstructions to allow hydrogen gas to escape and water to drain out of the box.

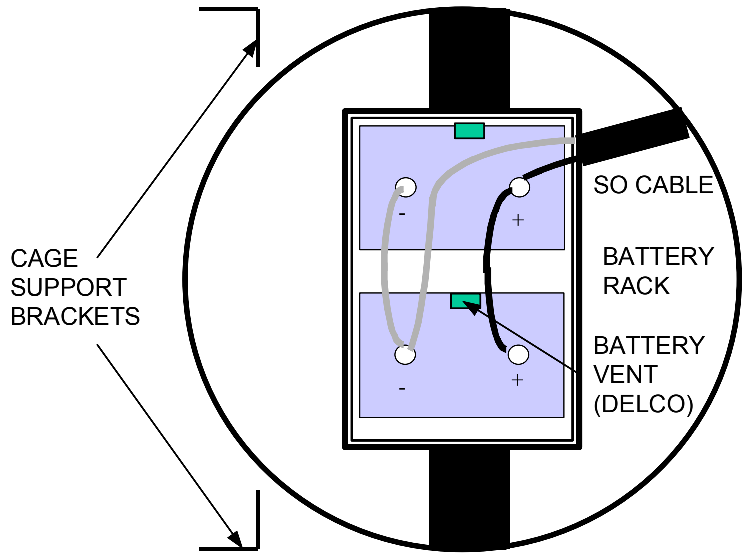


Figure 9-14

Battery pocket counterweights may be necessary depending on the size of the buoy, the number of batteries used and the stability of the buoy.

f. <u>Photovoltaic (Solar) Batteries – Major Aid Systems</u>.

(1) <u>Storage</u>. Secondary batteries for large PV systems are generally purchased for a specific installation. An inventory of cells is not maintained. In the event the battery is awaiting installation, the storage requirements outlined in section C.4.e.(1) apply.

(2) <u>Tracking</u>. Battery tracking Labels are not required to be installed on these batteries.

(3) <u>Installation</u>. Installation of major aid system batteries is detailed in the Short Range Aids to navigation Servicing Guide, COMDTINST M16500.19A.

g. Solar Distribution Box (SDB). The SDB is installed in a shelter near the Solar Charge Controller. The SDB has additional inputs for an auxiliary solar array and emergency battery. Up to ten loads may be connected to the terminal strip. The first three loads (1, 2 & 3) will be disconnected upon main battery failure. The emergency battery powers loads 4 through 10 when this occurs.

9E.

BATTERY INSTALLATION LABEL

U.S.C.G

BATTERY INSTALLATION

MO. JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

YR. 99 00 01 02 03 04 05 06 07 08 09

Function. The battery installation label is an optional label for use on secondary batteries to indicate the month and year the battery is installed. This provides a quick, visual indication of the age of the battery.

Features.

- Vinyl substrate.
- Adheasive backed.
- Easily punched.

Additional. The battery installation labels are available from UNICOR. For more information and prices contact: Mr. Dean Osborn at the factory, 817-413-3205 or 3206. If you have any problems, contact Mr. Abe Burgess in the DC office at 202-305-3752.

BATTERY TRACKING LABEL

PROPERTY OF

14-000000

U.S. COAST GUARD

Function. The battery tracking label is a mandatory label for use on minor aid secondary batteries to document them from "cradle to grave". Battery tracking labels are installed on a battery upon receipt, document where the battery is (physically) and updated as the battery moves from the unit to the aid and finally disposal.

Features.

- Vinyl substrate.
- Adhesive backed.
- Waterproof adhesive
- Sequentially numbered by district.

Additional. The battery tracking labels are available from Nutron Nameplate, Inc., 31269 Lorrain Road, North Olsted, OH 44070-0477, Phone 440-777-6660, FAX: 440-770-6664, Internet: www.nutronnameplate.com, or any local nameplate company using the statement of work available from Commandant (G-SEC-2A).

9E.

SINGLE BATTERY LOAD TESTER

Function. The Single Battery Load Tester is used to test 12 volt solar batteries used in aids to navigation. The tester is especially useful for solar power aids when just one secondary battery is installed as it is smaller, lighter and cheaper than the solar battery load tester (next Data Sheet).

Features.

- Two 24 inch wires with alligator clips.
- Operating instructions on unit.

Characteristics.

- Grey enameled case, 3-1/2x 1-1/2 x 1-1/4 (LWH in inches).
- 13 ohm, 5%, 11 watt, molded vitreous enamel type resistors

Additional Data. The Standard Battery Load Tester is available from Delta Integration, Inc., Phone: 717-392-2701.

9E.

SOLAR BATTERY LOAD TESTER

<u>Function</u>. The Solar Battery Load Tester is used to test 12-volt secondary batteries used in aids to navigation.

<u>Features</u>.

- Can test up to ten batteries at once.
- Two 36 inch wires with alligator clips.
- Carrying strap.
- Operating instructions on unit.
- Separate values for testing batteries at lantern on buoys.
- Calibration values printed on cover (unit should be checked for accuracy monthly).

<u>Characteristics</u>.

- Grey enameled case, 7-1/2 x 4-1/2 x 4 (LWH in inches).
- Sealed toggle switches.
- Vitreous enamel type resistors.
- NSN CG 6625-01-361-1357

<u>Electrical</u>. The load tester should be checked monthly to determine its accuracy. Using an AtoN voltmeter in the resistance mode (Ω), measure the resistance in each of the switch positions. Replace the load tester if the readings are outside the range printed on the cover.

<u>Additional Data</u>. The preferred method of load testing batteries is to test each battery individually. In the event this in impractical, then use of this tester on the parallel string is acceptable. The Solar Battery Load Tester is available from ELC Baltimore.

9E.

CAT V LOAD CENTER

Function. The CAT V Load Center (CVLC) is used in 12VDC lighthouses to provide a simple load center to protect circuits, and disconnects for equipment.

Features.

- Fiberglass NEMA 4X (raintight).
- 20 amp circuit breaker protection.
- Two input terminal blocks accept up to 1/0 AWG wire.
- Three remaining terminal blocks accept up to 10 AWG wire.
- Size: L W D (inches) 3.5 x 1.5 x 1.25.

Additional data. CAT V Load Center are stocked at the ELC Baltimore warehouse, are Headquarters controlled and available for approved projects. Requests for CVLCs shall be addressed to Commandant (G-SEC-2).

9E.

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9E.

LARGE LEAD-ACID BATTERY
(FULMEN SOLAR)

Function. These lead acid batteries are connected in series of six 2-volt cells to supply 12-volts DC to power fixed solar powered aids to navigation requiring more than 300 amp-hours. Exide Corporation imports these cells from France, therefore ensure adequate lead-time is planned when scheduling a project. The Fulmen Solar are identical in construction to the discontinued Yuasa EI/EJ/FHGS cells.

Features.

- Clear plastic case.
- Shipped filled with liquid electrolyte.
- Dry wet charged batteries are also available.
- Supplied with interconnection straps.
- Sizes from 400 Ah to 4400 Ah.
- Carrying device is needed for heavier cells.
- Fragile cell jars require careful handling and rock steady platforms.
- Freshening charge required on-site.
- Semiannual/annual watering required.
- Most reliable technology.
- Service life 10-20 years

9E.

Characteristics.

TYPE	NOM A.H. CAPACITY	Dimension per Cell (6 required)				ELECTROLYTE VOLUME Gal/Cell
		LENGTH* In.	WIDTH In.	HEIGHT In.	WEIGHT Lbs.	
Solar 400	400	8.11	4.88	15.87	45	1.1
Solar 470	470		5.71	15.87	54	1.5
Solar 550	550		4.88	20.43	59	1.6
Solar 650	650		5.71	20.43	69	1.9
Solar 750	750		6.54	20.43	81	2.3
Solar 900	900		5.71	27.32	96	2.7
Solar1200	1200	27	7.52	27.32	130	3.7
Solar1500	1500		9.17	27.32	162	4.6
Solar1850	1850		10.83	27.32	193	5.5
Solar2100	2100		10.83	33.23	228	7.1
Solar2500	2500		10.83	33.23	246	7.7
Solar3000	3000		15.71	32.28	331	9.9
Solar3750	3750		19.17	32.28	407	12.2
Solar4400	4400		22.68	32.28	484	14.4

*Per 12 volt battery

Additional Data. Fulmen Solar cells are ordered from GNB, Inc. Contact George Hunt at GNB, Inc., Phone 630-691-7813, Email: Ghunt@GNB.com.

9E.

LARGE LEAD-ACID BATTERY
(Sonnenschein Dryfit A600)

Function. These lead acid batteries are connected in series of six 2-volt cells to supply 12-volts DC to power fixed solar powered aids to navigation requiring more than 300 amp-hours. The cells contain gelled electrolyte housed in steel cases. This technology is sensitive to overcharge and therefore longevity is not as good as wet type batteries, but considered better than “absorbed” (Absolyte) batteries, however their construction is suitable for “active” platforms, Exide Corporation imports these cells from Germany, therefore ensure adequate lead-time is planned when scheduling a project.

Features.

- Plastic case.
- Shipped filled with liquid electrolyte.
- Supplied with interconnection straps.
- Sizes from 360 Ah to 3500 Ah.
- Carrying device is needed for heavier cells.
- Durable cell containers can be installed on active platforms.
- Freshening charge required on-site.
- Spillproof technology.
- Service life 10+

9E.

Characteristics.

TYPE	NOM A.H. CAPACITY	Dimension per Cell (6 required)			
		LENGTH* In.	WIDTH In.	HEIGHT In.	WEIGHT Lbs.
6/360	360	5.79	8.19	14.17	62
5/400	400	4.96	8.19	18.7	68
6/500	500	5.79	8.19	18.7	80
7/600	600	6.61	8.19	18.7	92
6/720	720	5.79	8.19	25.59	110
8/960	960	8.46	7.6	25.59	150
10/1200	1200	8.46	9.25	25.59	180
12/1400	1400	8.46	10.91	25.59	213
12/1700	1700	8.46	10.91	31.5	264
16/2300	2300	8.46	15.75	30.51	352
20/2900	2900	8.46	19.29	30.51	440
24/3500	3500	8.46	22.83	30.51	528

*Per 12 volt battery

Additional Data. Sonnenschein Dryfit A600 cells are ordered from Exide Corporation. Contact George Hunt at GNB, Inc., Phone: 630-691-7813, Email: Ghunt@GNB.com.

INDEX